AN ANALYSIS OF THE AGRICULTURAL AND INDUSTRIAL LIFE OF SOUTH EAST ENGLAND WITH ESPECIAL REFERENCE TO THE EFFECT OF THE DEVELOPING KENT COALFIELD THEREON.

Thesis submitted for the

Ph.D. Degree

by

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AN ANALYSIS OF THE AGRICULTURAL AND INDUSTRIAL LIFE OF SOUTH EAST ENGLAND WITH ESPECIAL REFERENCE TO THE EFFECT OF THE DEVELOPING ~~THAT~~ KENT COALFIELD THEREON.

Abstract of Thesis.

Introduction.

Chapter I Population Distribution and Changes illustrative of the major phases of the life of S.E. England.

An analysis of the 1931 Census of the region and a comparison with the Censuses of 1911 and 1921. The growth of the population and the relative importance and major features of distribution of its industrial and agricultural elements.

Chapter II The New Coalfield.

Its location, physiography and geology.

A short history of its discovery and development and a consideration of output and labour.

A description of transport and markets and their geographic control.

Chapter III Non-Agricultural Industry.

The geographic and economic conditions governing the location and development of the major typical industries of S.E. England. A description of labour, transport and market conditions and a consideration of the industries as consumers of Kent coal.

The Paper Industry

The Cement Industry

The Brick and Tile Industry.

Chapter IV Agricultural Industry.

An analysis of the physiographic background of agriculture: climate, topography, soil and drainage.

Some aspects of the economic background of agriculture - a broad consideration of markets; the distribution and type of farming population; the size and type of farms.

Present agricultural production, distribution and marketing. A comparison with pre-war conditions.

A correlation of agricultural conditions with the controlling factors of the physiographic and economic background and a consideration of subordinate agricultural industries in relation thereto.

Chapter V General Transport Considerations.

Water Transport and Port Conditions.

Inland Waterways

Some aspects of geographic and economic conditions at the ports; their trade and development.

Land Routes; their geographic control and present character.

Chapter VI Regional Planning.

Some consideration of the expected future development of the region from an examination of Regional Planning Reports. A summary of the industrial and agricultural life of the S.E. as reflected therein.

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Introduction.

The three South Eastern counties, Kent, Surrey and Sussex, form a clearly defined physiographic region, which, predominantly rural, has shown in the past a certain unity of economic life. Up to the closing decades of the nineteenth century, the main activities of the whole area were agricultural; industries were small, largely rural in character and unconcentrated into areas of predominant industrial interest. Since that period, certain factors have arisen to disturb this unity of outlook. The most important of these is the rapid growth in size and importance of the London area, as a population focus (and hence as a market); as a centre of industrial development and as a port. Different parts of the South East have responded to this development in different ways. To the S. and S.W. of the area, the effects of the population factor have been most apparent and direct while the locational advantages of N.Kent in relation to the growing industrial and port activities of London, together with the invention of Portland cement and the introduction of pulp into paper manufacture, have caused here the development of a primarily industrial region.

During the last twenty years, a second major factor has arisen; the discovery and exploitation of coal in Kent. It is, as yet, early for the complete significance of this factor to

manifest itself, but that eventually it must profoundly alter the economic life of the area is inevitable. The nature of the change and the range of its influence will, of course, be intimately connected with such questions as the future utilisation of coal and may not be gauged by the development followed in older coalfields.

On a background of agricultural unity, these forces of growing population pressure, and of growing and potential industrialisation are imposing themselves. The aim of this thesis is to examine the natural and economic environment which controls and moulds the strength and direction of development and to show the present state of interaction between the various phases of economic activity.

The key to many of the present aspects of agricultural and industrial life lies in the rapid expansion of population and in the growing domination of the London area. It has, therefore, been considered suitable to commence with an analysis of population distribution, growth and type. This analysis shows broadly the major changes and developments in the life of the area and leads naturally to a discussion of its various aspects.

The coalfield, potentially the greatest single internal stimulus to change in economic life, receives special attention. Its discovery, exploration and present utilisation form the opening paragraphs of an important chapter in the history

of S.E. England and by the study of it in all its aspects, an attempt is made here to show its present and possible future significance.

In the consideration of industrial and agricultural life, it has, of course, been necessary to be selective. Only those industries and those aspects of agriculture have been discussed which it was felt most truly indicate the essential character of the area. The physiography of this region is well-known and much described. Here it receives attention only as a background to economic utilisation. It is superfluous to emphasise its importance in this respect.

Wherever possible the sources of information, of maps and diagrams, are indicated. The work has been retarded for the inclusion of 1931 Census material, which was extracted as soon as it became available at the Census Office. Unfortunately, the industry tables of the Census, which contain information which would have greatly facilitated the work, will not be available until late in 1934.

There are practically no public sources of detailed information concerning industry and much of Chapters II and III is based on information kindly supplied by officials connected with the coalfield and various other industrial enterprises and on personal observation.

For agriculture, there is a wealth of statistical material available through the Ministry of Agriculture and this has been

supplemented with information from farmers, from agricultural advisers and organisers, from agricultural research-workers, and again from extensive personal observation.

Through the help of the Chamber of Shipping, introductions to various port authorities were obtained and from them resulted much useful information on port conditions and trade.

Chapter I.

POPULATION DISTRIBUTION AND CHANGES ILLUSTRATIVE OF THE MAJOR PHASES OF THE LIFE OF S.E. ENGLAND.

During the 20 year period 1911-1931, the population of Kent, Surrey and Sussex has increased by 24%, whereas the increase for England and Wales as a whole has been but 10·7%.

This high increase is largely to be accounted for by the inclusion in Surrey and Kent of part of the Outer Ring of London. Into this area which lies between the county boundary of London and the boundary of Greater London, the population of London has steadily been migrating and in Surrey the population of the Outer Ring shows an increase of 33% during the ten years 1921-1931, and in Kent of 27% for the same period.

Outside the Greater London area, however, Surrey and Kent show population increases during 1911-1931 of 24·9% and 10% respectively and Sussex of 14%. These figures are considerably in excess of the natural growth of population within the areas and indicate a general migration into the three counties.

Table I shows the actual population of each county for 1911, 1921 and 1931; the proportion it forms of the total S.E. population and the density per square mile within each county

while Table II shows the percentage increase of population for the period.

TABLE I

Population of Kent, Surrey and Sussex 1911, 1921, 1931.

	Kent			Surrey			Sussex		
	1911	1921	1931	1911	1921	1931	1911	1921	1931
Total Population	1045591	1141666	1219273	845578	930086	1180878	663378	727997	769859
% of Total SE. Population	40·9	40·8	38·4	33·1	33·2	37·8	26·0	26·0	24·3
Density per sq.m.	685	768	768	1152	1280	1664	448	506	512

TABLE II.

Intercensal Increases in Population 1911 - 1931.

	Kent	Surrey	Sussex	Total SE England	England and Wales
1901-1911	8·8	29·4	10·1	15·2	10·9
1911-1921	9·2	10·0	9·7	9·6	4·9
1921-1931	6·8	27·0	5·8	13·2	5·5

Although Kent has the largest population, Surrey is by far the most densely settled area, and while the whole area shows a rate of increase far greater than the average for England and Wales, this increase is very much more marked in Surrey than in Kent or Sussex. The very strong pull of population in this direction is to be accounted for by the ease of communication with London throughout the Thames valley and along the dip-slope of the North Downs, and by the amenities for suburban settlement offered by the region as a whole[1].

The urban nature of the Surrey population is strongly marked (see Table III). The urban districts of the county contain 83% of the population, the highest figure for any county in England or Wales with the exception of Middlesex where very similar conditions of population growth and type exist. This extreme urbanisation of the county has had a big effect on industry, as will be shown later.

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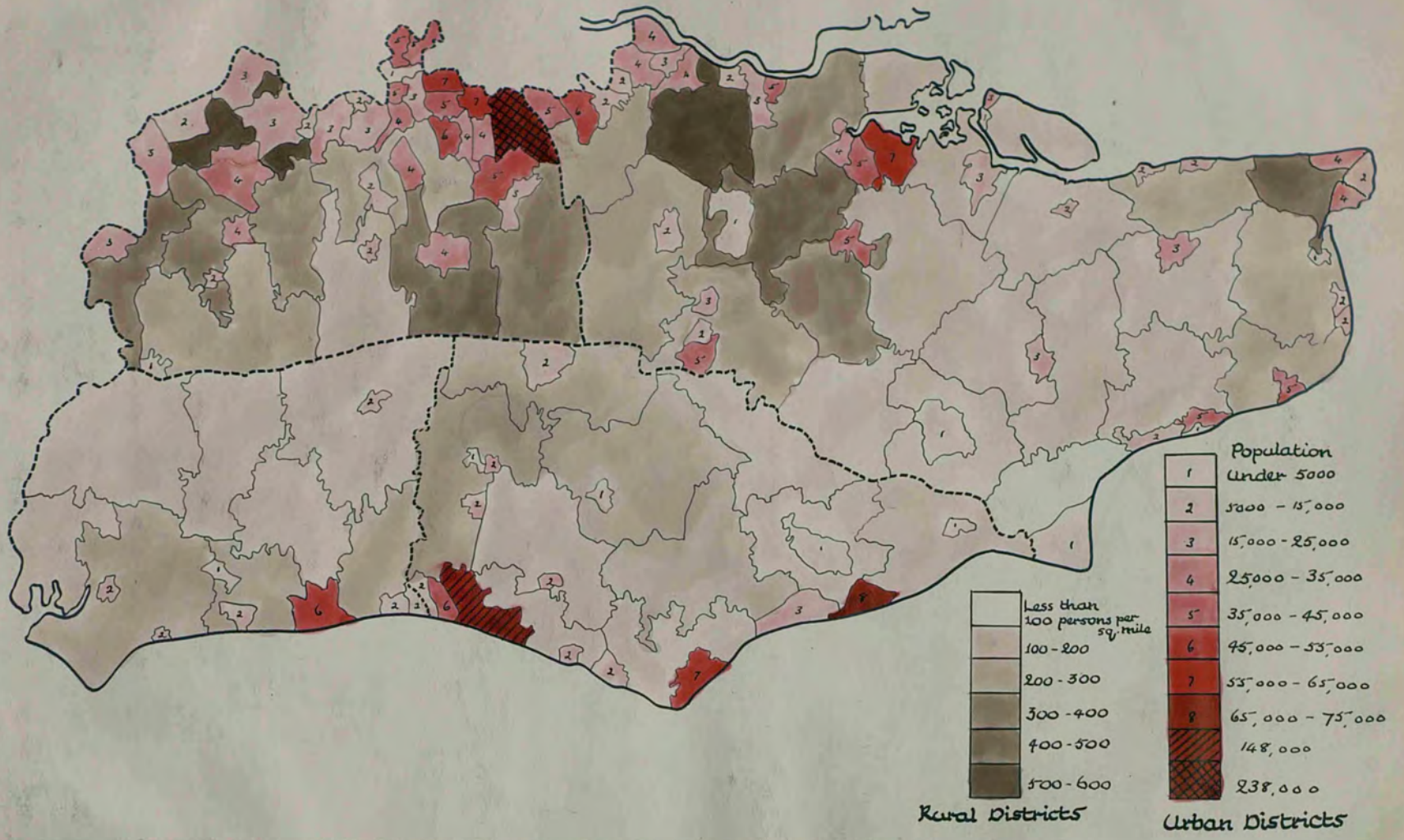
(1) N.B. There has been a greater electrification of train services in this quarter of Greater London than in any other.



POPULATION DISTRIBUTION IN S.E. ENGLAND 1931

Fig.1. Prepared from Census Returns of 1931.

TABLE III.

Urban Population.

	Kent			Surrey			Sussex		
	1911	1921	1931	1911	1921	1931	1911	1921	1931
% of Total Population formed by Urban Population	71	72	72	83	84	85	70	68	68
Percentage of Total area formed by Urban Districts	12	13	14	26	29	32	7	7	9

Urbanisation has proceeded far less rapidly in Kent than in Surrey. A large part of the area easily reached from London lies along the Thames estuary and offers little attraction for residential settlement, being either too marshy or already developed industrially. In contrast to Kent and Surrey, Sussex shows a slight relative decrease in urban population and is the most rural of the three areas.

Fig. 1 shows the present distribution of population throughout the region (Fig.2 provides a key map to the Urban and Rural Districts). Urban population shows six main concentrations.

DIAGRAM OF KENT SURREY AND SUSSEX SHOWING COUNTY AND MUNICIPAL BOROUGHS URBAN AND RURAL DISTRICTS

Fig.2.

The South Metropolitan area.

The South Coast Resorts.

The Thames Valley residential area.

The North Kent industrial area.

The Medway estuarine area.

The first of these areas consists of an almost continuously built up group of urban districts extending roughly from Wimbledon, Merton and Sutton on the W. to Sidcup on the E. and stretching out on the S. in long tongues which run up the dry dip-slope valleys of the chalk (following communication lines) at Coulsdon and Caterham. These tongues have not yet reached to the scarp face of the Downs. Croydon, the biggest population centre of the SE (238,000 persons) is included here and the region is characteristically urban becoming gradually more sub-urban with increasing distance from the centre. It definitely forms part of the London area, and is distinguished by two types of industry. Firstly a big development of all commercial and non-factory industry attendant on the existence of a big population and secondly, a number of diverse small factory industries which represent an outward spread of London manufactures. It is a region with no character of its own.

The South coastal resorts form the region of second greatest population concentration. Brighton and Hove together have a population of over 200,000; Hastings and Bexhill 76,000;

Eastbourne 57,000, and Worthing of 46,000. Margate and Ramsgate are slightly smaller. Population forms no continuous belt as in S.London, but is grouped round each watering place which may be separated by areas of considerable or of very thin settlement. Industry in these areas was originally concerned with providing for the needs of summer visitors, and a certain amount with fishing. Growth of popalation, however, has caused a widespread growth of commercial non-factory industry as in the S.Metropolitan area, and, notably at Brighton, there has been a corresponding growth of diverse small factory industry. This is very largely the result of the availability of suitable labour, the presence of a local market and easy connection with the wider markets of London[1].

Apart from their tourist trade these population centres have a different character from Group I. They have grown up as individual units and not from the overflow of a neighbouring centre. It is significant, however, that Brighton, the nearest to London, should be by far the largest. Nevertheless the ease and quickness of transport developed between London and the S. coast towns, and with Brighton in particular, is causing them to become suburban to London. This is a very restricted development as yet, but one that is likely to grow.

The third group, the Thames Valley area, is mainly residential in character. There is no marked concentration of

---

(1) Various articles like Floor Polish and Toilet Accessories are made in Brighton.

population at any particular point but an even spread along the N. of Surrey - a river valley population concentrating along the Thames, Wey and Mole valleys, and consisting mainly of two types: a suburban population which can afford time and money to make the longer journey to London than can most of the population in Group I, and a local population concerned with supplying the needs of this widely spread market. These needs are chiefly concerned with food supply and factory industry is almost non-existent.

The North Kent area of population concentration contains a considerable surburban component, especially in the Bexley district, but is in the main industrial. It centres round the engineering of Erith; the Paper and Cement manufacture from Dartford to Gravesend, and round the shipping activities of Gravesend.

In the Medway estuaries area, population concentration is a result of the naval, military and dockyard interests of Gillingham and Chatham and of the shipping, general transport and market activities at Rochester.

Apart from these major areas of population density, the gap towns of Guildford, Reigate, Maidstone and the port of Dover are big settlement centres. In the first two, the population is almost purely residential and represents a farther extension and growth of the North Surrey suburban development, pulled by transport conditions to these particular

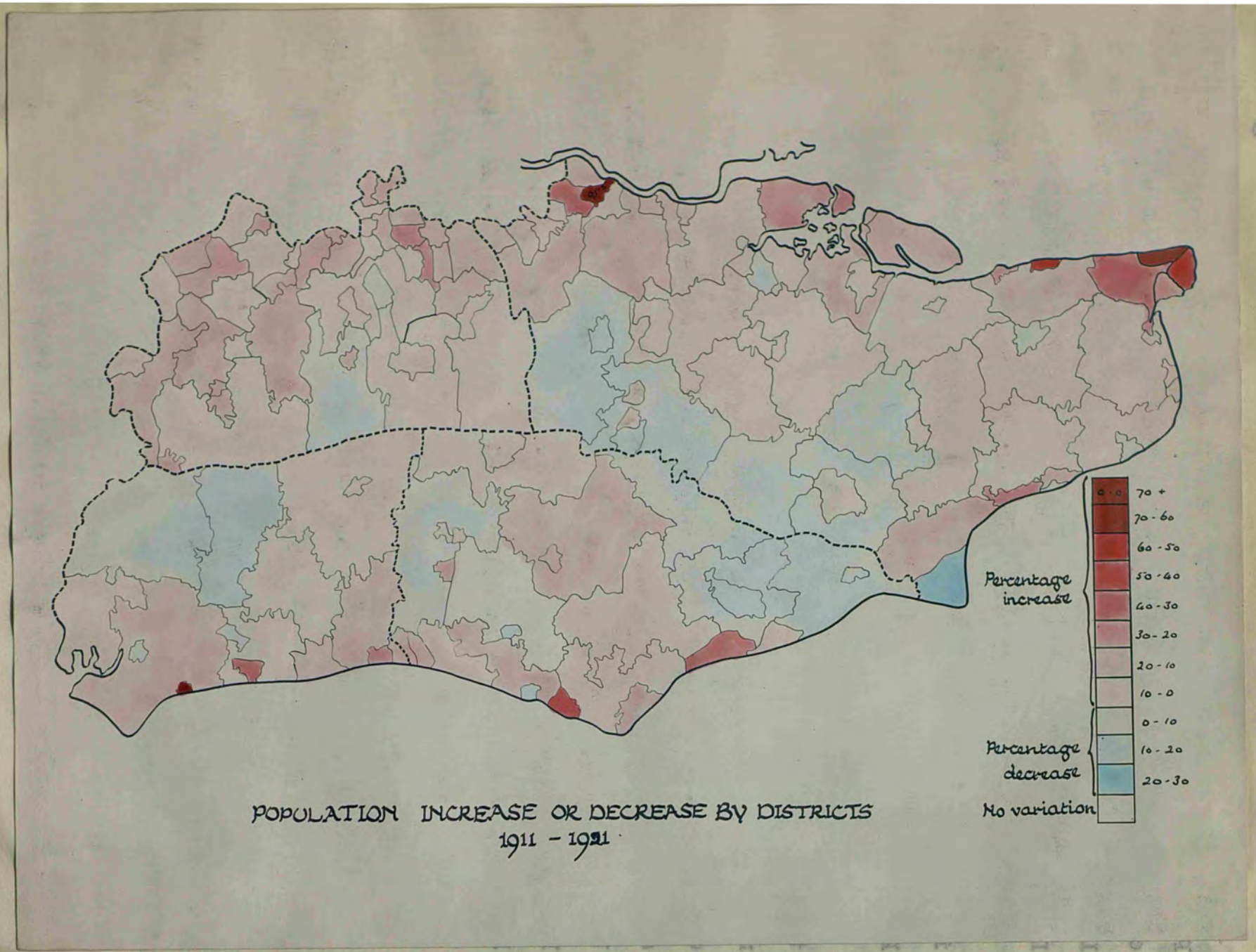
points. At Maidstone and Dover it is largely industrial and commercial and only partakes of the suburban development of London to a very small degree at Maidstone and not at all at Dover.

Tunbridge Wells, the remaining centre of considerable size, is the only spa of the region, is very favoured for residential purposes and very largely suburban to London.

The distribution of rural population reflects a dual control. The first is that of suburban development comparable in many ways to that controlling the urban settlement. The most densely settled rural areas are, as would be expected, those adjacent to the major urban areas. There is, in addition, a belt of high rural density following the line of the London-Brighton rail. The continuation into the rural districts of high densities is most marked in Surrey, with the exception of the thinly settled Leith Hill area (Dorking Rural District).

The second control is that of industrial and agricultural development. The high densities of the rural districts of Dartford, Malling, Maidstone and the East Kent area reflect both marked agricultural and industrial development, while that of Westhampnett and East Preston is agricultural.

Where they are sufficiently remote to escape the spread of London, settlement avoids the Chalk Downs. To the E. and W. of the Brighton-London line and in Kent, E. of the Medway



POPULATION INCREASE OR DECREASE BY DISTRICTS
1911 - 1921

Fig.3. N.B. The very large increase in certain coastal resorts is due to the fact that the 1921 Census was taken in June, instead of in April as is usual, and therefore many summer visitors are included in these areas.

valley, the Downs are thinly settled. The seaward extremities of the E. High Weald, of the Weald Plain and Romney Marsh show a similar thinness. They have no dense agricultural settlement, and do not in general attract a residential population. The W. High Weald, being nearer to London and of particularly attractive scenery, especially in and round Ashdown Forest, has a very considerable residential settlement.

The variation in population density is shown in Figs 3 and 4.

With the exception of certain rural areas which show little variation when the two maps are considered together, there is a general increase, with three areas of especially marked relative growth. These are that part of Kent and Surrey forming roughly the S. part of the Outer Ring of London; the maritime plain of Sussex; and East Kent. In all cases, the increase has been more marked during 1921-1931 than during the earlier period. A comparison with Figs 5 and 6 shows that the increase in each of these areas is largely due to extensive inward movement. In the first area this is, of course, from London, and here is the greatest absolute as well as the greatest relative growth; in the second it is due to the rapid increase in popularity of residential settlement in the area. The enormous relative increase of 91·2% in Newhaven Rural District (actually an increase of only some 3,000 persons),

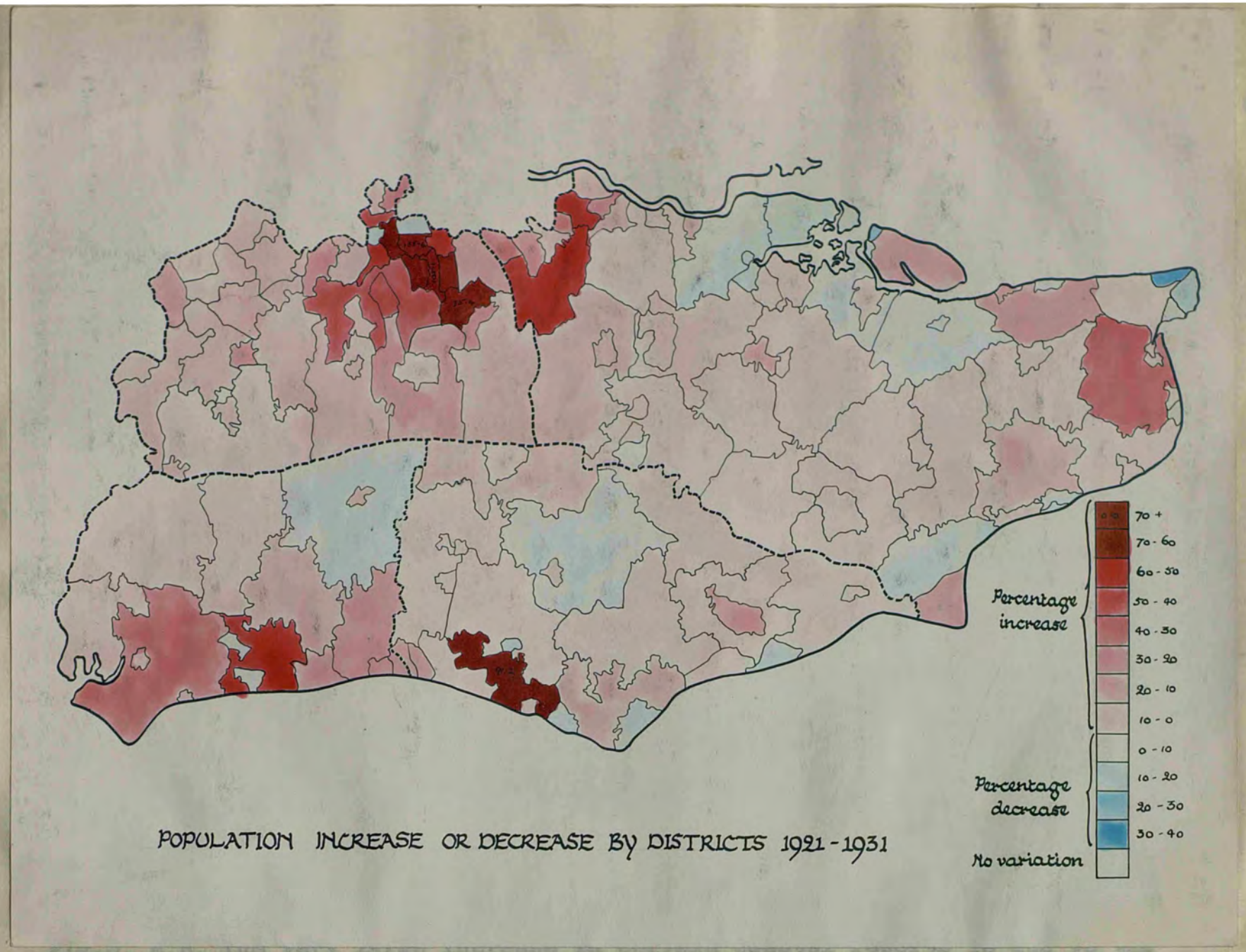


Fig.4. N.B. The decrease of population at certain coastal resorts is due to the fact that the 1931 Census was taken in April and the 1921 in June. (See note to Fig.3.)

is largely due to the mushroom growth of the bungalow town of Peacehaven.

Of more interest than the general population variation is the gain or loss by migration in each district. It shows the localities, which under present conditions are attracting or repelling settlement. In the earlier decade there was widespread movement from both urban and rural districts in the less populous parts of the country. This is partly to be accounted for by losses due to the war[1]. The second decade, however, shows an inward migration in almost all areas. The exceptions are towns already wholly built up, and where, as a result, expansion is difficult, e.g. Wimbeldon and Kingston; areas whose population has been decreased by the gradual reduction of wartime concentrations, e.g. in the estuarine area of the Medway, and in the Erith district; and lastly[2], in certain rural areas, more especially in the North and Mid-Kent region, i.e., the region of greatest industrial and agricultural concentration. Dartford and Gravesend alone of N.Kent have not shared in this outward movement, slight though it is in most cases, and the only big inward migration due to industrial development is in Blean, Eastry and Elham, the new mining

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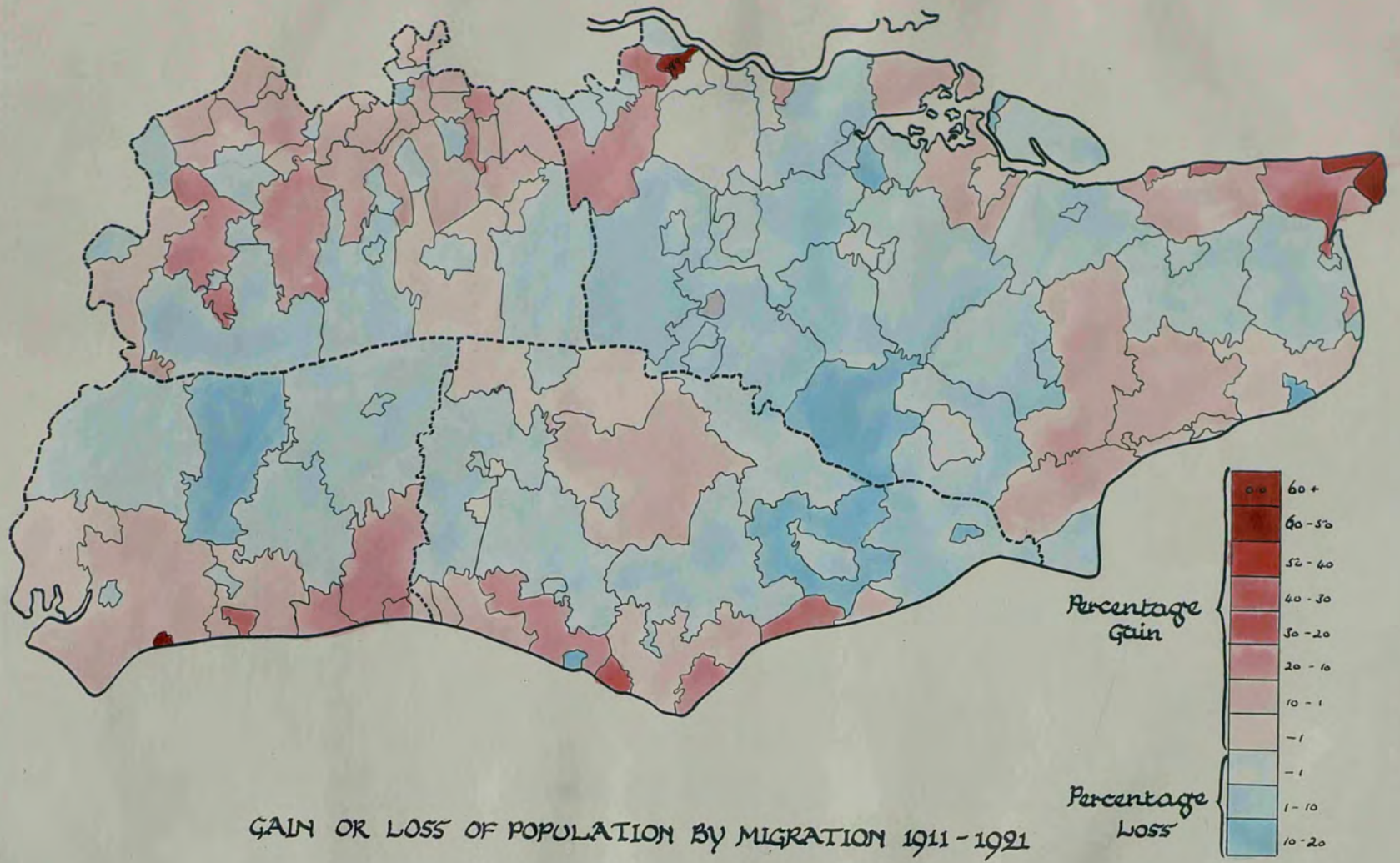
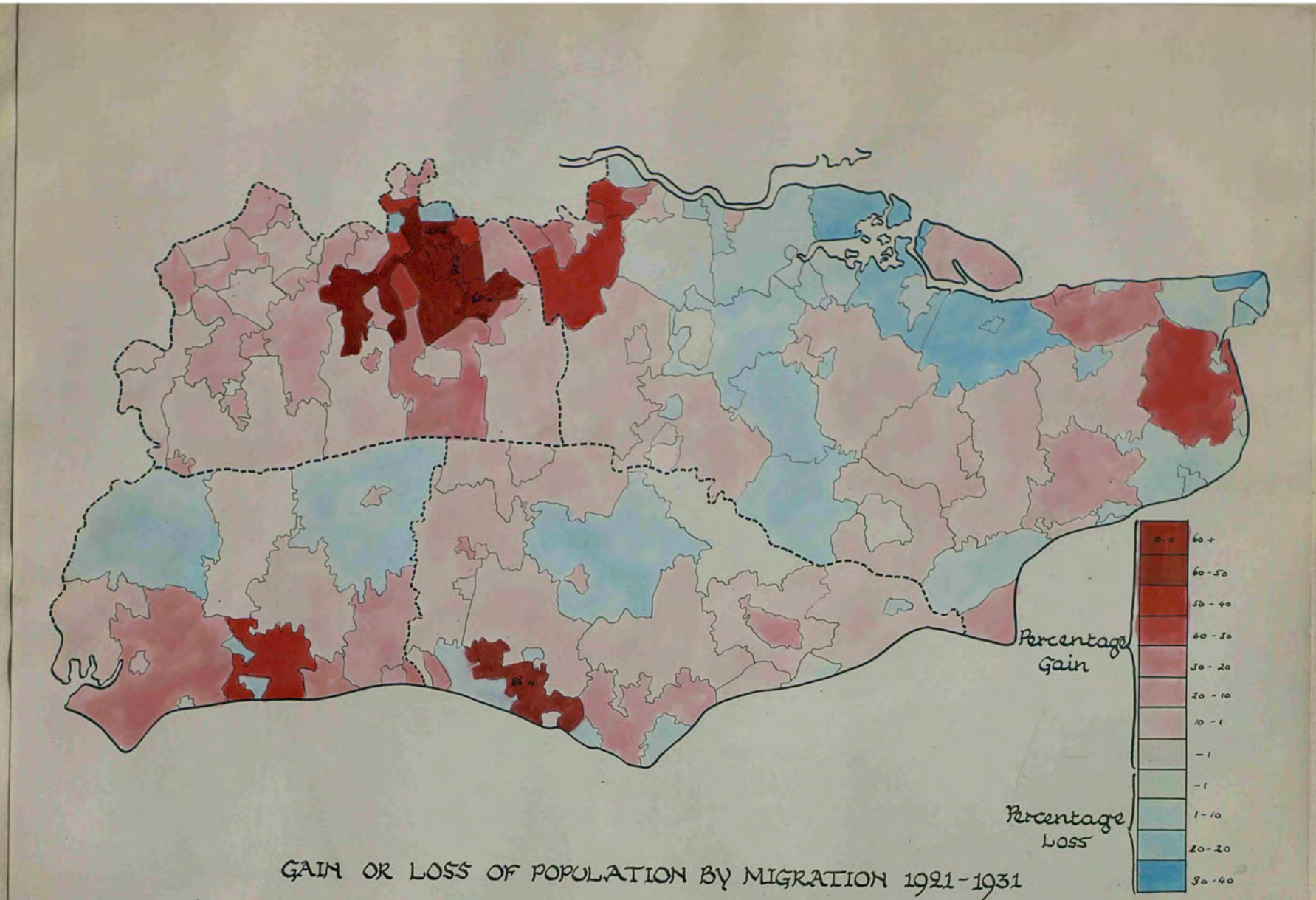
(1) This loss has been estimated for the county as a whole at 3% of the 1921 male population, and the marked loss in garrison towns such as Chatham and Dover must be largely due to this.

(2) See note to map explaining the incomparability of the coastal town figures.



GAIN OR LOSS OF POPULATION BY MIGRATION 1911 - 1921

Fig.5. N.B. In connection with coastal resorts see notes to Figs 3 and 4.



GAIN OR LOSS OF POPULATION BY MIGRATION 1921-1931

Fig.6. N.B. In connection with coastal resorts see notes to Figs 3 and 4.

TABLE IV.

Showing the more important occupations of Males in Kent, Surrey and Sussex for the years 1911, 1921, 1931. Proportions per Thousand aged 12 years and over.

	KENT			SURREY			SUSSEX		
	1911	1921	1931	1911	1921	1931	1911	1921	1931
Fishermen	3	3	1	-	-	-	9	4	2
Agricultural Occupations	141	128	77	104	88	69	178	163	142
Mining & Quarrying "	6	7	15	-	-	-	-	-	-
Workers in Lime, Cement & Coke etc.		10	7						
Makers of Bricks, Pottery & Glass	21	6	6	3	3	3	4	4	5
Chemical Workers	5	3	3	-	-	-	-	-	-
Metal Workers	-	77	67	-	62	59	-	47	35
Electrical Workers	-	11	17	-	12	20	-	9	15
Workers in Skins & Leather	3	2	3	-	-	-	-	-	-
Makers of Textile Goods & Articles of Dress	14	11	8	18	13	11	19	14	10
Makers of Foods & Drinks	-	13	12	-	13	10	-	16	16
Workers in Wood	-	31	35	-	34	36	-	37	41
Makers of Paper etc.	8	9	13	-	-	-	-	-	-
Printers, Bookbinders & Photographers	-	10	11	-	16	20	-	8	8
Builders etc.	50	34	45	74	41	56	66	42	60
Painters & Decorators		18	20		25	26		23	27
Transport Workers	90	96	97	86	92	93	93	96	103
Commerce, Finance & Insurance	-	82	103	-	110	136	-	106	124
Public Administration	-	76	53	-	58	30	-	37	14
Professional Occupations	-	26	28	-	42	45	-	35	33
Personal Service	-	30	34	-	31	34	-	45	55
Clerks	-	35	53	-	70	102	-	33	38
Unoccupied & Retired	192	159	114	206	169	117	206	184	138

N.B. Compiled from the Census returns of 1911, 1921, 1931. Methods of tabulating the Census material have differed in each of the three years and while it has been possible to obtain a comparable basis for all the occupations in 1921 and 1931, this has only been possible for certain occupations of 1911. These figures only therefore are shown.

TABLE V.

The Employment in the major industries of SE. England in 1921.

		Kent	Surrey	Sussex
A.	Agricultural Industry.			
	Farming and Market Gardening	44921	13533	30289
	Malting and Brewing	2719	2063	1329
	Grain Milling	1220	603	506
	Tanning & Leather Dressing,etc.	864	966	156
	Oil Cake etc. manufacture	1660	-	-
	Agricultural engineering	972	46	295
B.	General Non-Agricultural Industries			
	Paper Manufacture	7752	192	22
	Cement "	8207	117	464
	Brick & Tile Manufacture	3132	834	1162
	Chemical "	1513	627	447
C.	Industries connected with Transport.			
	Ship-building & Marine Engineering	15692	331	270
	Manufacture of Road Vehicles	3526	7662	1945
	Building & Repair of Rolling Stock	751	25	769
	Manufacture of Aeroplanes etc.	731	739	16
D.	General & Electrical Engineering	20142	3842	2486

Compiled from the Industry Tables of the 1921 Census.

district. Elsewhere, generally speaking, the inward movement is concerned with a residential population and one attendant on its needs.

Changes in the balance of the various types composing the population are shown in Table IV which shows the proportions per thousand of males in the main occupations of each county in 1911, 1921 and 1931. Agriculture, once the all-important occupation in each county has shown a rapid decline and in Kent and Surrey now no longer employs as many men as does transport[1]. The increase in the importance of occupations connected with urban growth, such as building, commerce (which includes all retailing business) and personal service, is most marked. The relative importance of the old-established industries native to the region, has, with one exception, declined. That exception is the paper industry.

Table V shows the employment in the major industries of SE. England in 1921[2]. In all branches of industry Kent is more important than Surrey and Sussex. Agricultural industry is of far greater importance than any other group in all three counties. Its present position and development will later be examined (Chapter IV.)

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(1) It must be remembered, however, that in many classes of occupation, of which transport is one, but agriculture is not, a proportion of the workers living in Kent and Surrey are working in London and are not, therefore, representative of industry in either county.

(2) No later material in connection with general industrial employment is available. The broad conclusions of the table, however, are true of present-day conditions.

Coal-mining, a development mainly of the last decade, is not shown on this Table, but is the most significant industrial development in the area. Hitherto the main established industry characteristic of the area has been Paper-manufacture, Cement manufacture, and Brick and Tile manufacture. It is proposed to examine these industries in detail, and show the present interaction, and possible future development, of old and new industrial growth.

The great development in Kent of ship-building and marine engineering is concentrated at the Government dockyards of Chatham and Sheerness. It is an industry fostered by natural advantages at those points, but governed by special circumstances and cannot be considered as part of the natural industrial development of SE. England.

General and electric engineering is widely diffused and does not form an organised industry except in Kent where there is a development of engineering industry in the Erith district but this is to be regarded rather as an outward spread of London industry than as one characteristic of the region under discussion and the same applies to the development of road vehicle manufacture, most developed in the suburban district of Surrey.

In general the most marked feature of population trends is the gradual subordination of the area to the extension and

requirements of the London population. Although this aspect now largely dominates the human and economic geography, the industrial and agricultural life of the area has not suffered therefrom. It has acted rather as a stimulant and sometimes as a director of these activities and where these have shown a decline, the causes for it must in general be sought elsewhere than in the changes of population distribution and type.

The effects on this region, widely residential and agricultural, and locally industrial, of the exploitation of a coalfield within its borders will be discussed in the next and subsequent chapters.

Chapter II.

THE NEW COALFIELD.

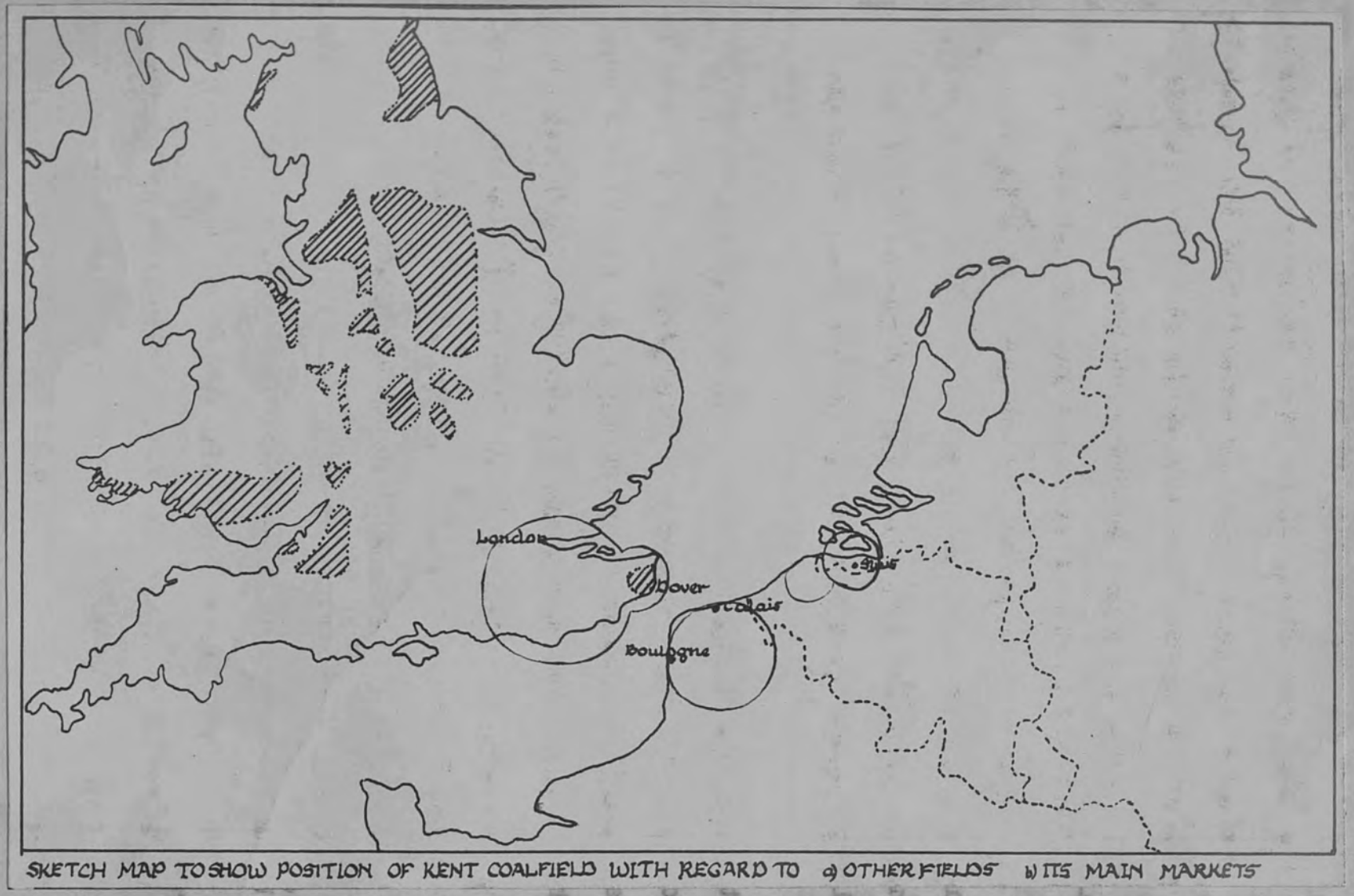
Location, Physiography and Geology.

The new coalfield occupies an area of some 250 sq.m. of what has always been purely agricultural country, in a region unconnected with industrial enterprise, but which, nevertheless, is not remote from industrial areas and which, owing to its key position with regard to intercourse with the Continent, has never been a stagnant area. Its location with regard to the other coalfields in England and Wales is shown in the map (Fig.7) and the table below shows the distance of all the English and Welsh coalfields from the London Area.

TABLE VI.

Rail mileage to London market from coalfields of England and Wales.

Kent	65 miles	S.Wales	180 miles
Gloucester & Somerset	120 "	N.Wales	185 "
Warcs.& Worcs.	115 "	Lancs.	198 "
Staffs	146 "	Durham	245 "
Derby	130 "	Northumber-land	275 "
Yorkshire	175 "	Cumberland	310 "



SKETCH MAP TO SHOW POSITION OF KENT COALFIELD WITH REGARD TO a) OTHER FIELDS b) ITS MAIN MARKETS

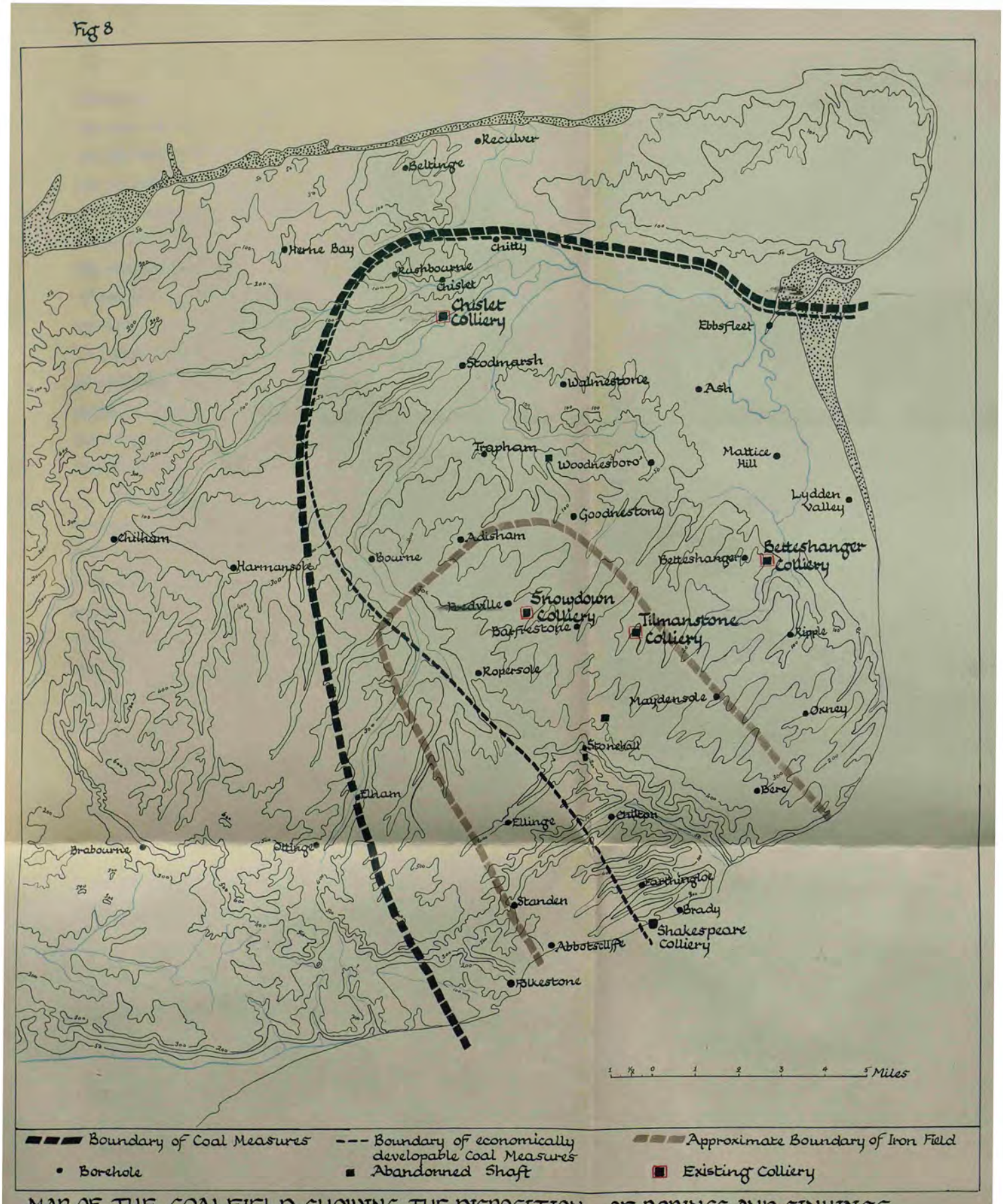
Fig.7. Note: (1) Superiority of Kent area with regard to London & Continental markets.
(2) Continental markets are being developed before the London market (see Section on Markets).

The question of markets will be considered more fully later but the position of the field with regard to the London market is one of major importance in considering its location. It is some 60 miles nearer than any other field in England or Wales and more than 100 miles nearer than the big fields of Northern England and South Wales which supply the bulk of London coal. The importance of the nearness of this market, especially in view of the growing industrialisation of outer London, cannot be over-estimated, and the geographical advantages with regard to it possessed by the Kent field are obvious.

Self-evident also is its advantageous position with regard to France, Belgium, Germany and the Netherlands, four of the biggest coal customers of Great Britain and in the case of Spain and Italy, the advantage in distance which the South Wales area possesses is very slight. The more detailed interrelation of the coalfield and its sphere of influence will be dealt with more fully below, and the more immediate location of the field now considered.

The area of proved coal-measures underlies a rough quadrilateral of land whose northern boundary follows a line stretching inland just N. of the River Stour, bending somewhat abruptly S. and crossing that river a little to the E. of Canterbury. Continuing S. across the dip slope of the North Downs, the boundary emerges at the coast to the S. of

Fig 8



MAP OF THE COALFIELD SHOWING THE DISPOSITION OF BORINGS AND SINKINGS

Folkestone. On the S. and E. the coal measures underlie the sea: the distance of their extension has not been proved but for considerations of practical mining the seaward limit may be taken at about 3 miles from H.W.M. Over the SW. part of the area thus defined, the coal measures, though present, contain but thin seams of poor coal so that the boundary of the economically developable field must be placed further to the NE. bending SE. in the neighbourhood of Bridge and reaching the coast about 2 miles SW. of Dover.

This region is mainly occupied by the southern extremity of the chalk ridge of the North Downs which reaches its greatest height within the area in the country SW. of Dover and dips gently NE. to the shallow syncline of the Richborough-Stourmouth area in which Eocene beds are preserved.

The relief is strongest in the region round the Dour valley where heights between 400 ft. and 500 ft. rise steeply from nearly sea level. The hill tops here have a markedly flat plateau-like character, the edge of the plateau corresponding closely to the 400 ft. contour; the valleys are steep-sided and deep. This accidented type of relief, which gives rise to some very beautiful scenery behind Dover, becomes very much smoother to the N. and E. The country opens out, the valleys become wide and shallow and the summits gently rounded.

With two notable exceptions the valleys trend NE-SW and are dry. The exceptions are the valleys of the Dour and Stour

rivers which carry the main drainage of the region. The Dour, in its middle and lower course, has cut a deep narrow valley across the grain of the country - an alignment probably influenced by the NW. trend of the joint system in the chalk. A similar direction is taken by the Bishopbourne section of the Little Stour and this may be attributable to the same cause.

As elsewhere on the North Downs, considerably cappings of clay-with-flints occur; these attain a thickness of over 20 ft. on some parts of the "400 ft. platform" in the SW., but are less widespread as the dip-slope of the chalk is descended. The clay is everywhere much mixed with material from the Eocene formations and elsewhere and, while varying considerably from place to place, its general character is loamy or even gravelly, a fact which has important bearings on land-utilisation in the area.

To the NE. the chalk disappears beneath the sands and marls of the Lower Eocene formations which here form a chain of low rounded hills, nowhere rising much above the 100 ft. contour, stretching from Ash to Canterbury and presenting a moderate sinuous scarp to the S. On the N., the land falls gently to the Stour; a wide alluvial floored valley consisting of extensive areas of drained water meadows and marshland.

This type of country is extended in a tongue to the SE. along the Lydden Valley, which is separated from the sea by

a belt of sand-dunes about ½ mile wide.

The centre of the southward loop of the Stour near its mouth is occupied by a long spit of old shingle which carries the Thanet road from a little beyond Sandwich to Cliff's End. The spit widens to about ¼ mile across its southern end and considerable quantities of it were used in connection with the sinking of pits at Snowdown, Tilmanstone, and Waldershare (a now disused pit).

The coastal topography to the S. of the dune region features a level plain of Eocene rocks, largely covered by brick-earths, in the neighbourhood of Deal and Walmer, and the gradual rise of the chalk cliffs to the S. These cliffs are recessed from the shore at the beginning of the chalk outcrop, but on reaching the sea at Kingsdown, their continuity is interrupted only by a deep combe at St Margaret's Bay before the complete notch of the Dour valley.

Although it is not proposed to deal fully here with the agriculture of this region, yet at this point it is worth considering the general utilisation of the land in order that the real character of the area may be appreciated.

It is a region of great variety in soils. The alluvial of the Stour and Lydden valleys form fine water meadows. They are much prized as pastures for growing and breeding stock and certain areas have valuable fatting properties.

They are capable of carrying a considerable head of stock, though of late years they have been much understocked owing to the general depression in the stock industries.

Here, as elsewhere in Kent, the Thanet beds and brick-earths form extremely fertile soils and are almost entirely under the plough or planted with orchards. Across the northern part of the coalfield they form a region of intensive agriculture which extends up the lower part of the chalk dip-slope where light, hazel loams occur.

Owing to widespread superficial deposits, the chalk does not in general give rise to typical downland pastoral farming. The clay-with-flints forms strong loams, excellent for wheat and the chalk country is much cultivated especially on the plateau areas.

The characteristic of the whole region is, therefore, intensive agricultural utilisation with considerable variation correlated mainly with varying soil conditions. Of the total cultivated area some 55% is under arable farming, and the cultivated area forms 80% of the total area.

The other industries of the region are mainly concerned with the development and maintenance of sea-side resorts along the coast, and the various activities of Dover as a port and garrison town. Of industry organised as such, there is very little: a small canning factory at Deal; an old-established paper-mill at Dover, and the manufacture of bricks, tiles and

pottery on the brick-earths round Deal and Canterbury.

On this background of agricultural and sea-side maturity the coal-field is imposed.

Of the four collieries now being worked, three, Snowdown, Betteshanger and Tilmanstone are situated on the chalk, and the fourth, Chislet, on the Tertiary formations.

Snowdown is located near the 200 ft. contour on the gently sloping side of a shallow valley; Tilmanstone on a ridge of about the same height which falls gradually to the SW., SE., and N., and Betteshanger on lower ground just above the 50 ft. contour. In each case the topography provides an admirable surface for the colliery buildings - firm, well-drained and uncramped, with room for expansion in any direction in accordance with the demands of industrial development. Chislet lies to the NW. in the Stour valley at a point just above the 50 ft. contour where the river swings against the outcrop of the Tertiary beds. Surface conditions here are slightly less good, any industrial development to the S. being checked by the low-lying Stour valley. Difficulties are likely to occur both at Chislet and at Betteshanger owing to their location on the margin of an extensive tract of low-lying land. The Stour valley is already elaborately drained and dyked and though it is scarcely possible to predict with any accuracy the amount of subsistence likely to occur in any area on the extraction of mineral beneath, yet in this area

a subsidence of only 1 foot would be sufficient to interfere with the existing fall of the dykes, which in some cases is only six inches per mile.

The disposal of water from the collieries also presents certain difficulties. The water supply is mostly obtained from the Greensand and Oolites underlying the chalk and is soft and good, but the disposal of surplus water is not easy in a region where there is a complete absence of surface drainage as at Snowdown and Tilmanstone or where any discharge of water is likely to add to already difficult drainage conditions as at Betteshanger and Chislet. The surplus is disposed of by soakage, but already there is some danger of the water pumped from Tilmanstone causing flooding in the vicinity of Buttsole near Eastry, towards which the soak-away trench runs and at Betteshanger the erection of pit-head baths has been much hindered by the problem of the disposal of the waste-water.

There are no difficulties with regard to the disposal of the colliery tips. At Snowdown and Tilmanstone folds in the chalk are utilised; this involves a certain waste of good agricultural land but minimises the disfigurement of the country by to some extent concealing the tips. At Betteshanger part of the poorer marshland to the E. has been bought and on this the waste of the colliery is dumped, while at Chislet the low ground between the pit and the river is utilised.

In the early days of the field when the risk of spoiling this part of England by working coal was a topic of wide discussion, schemes were suggested for carrying the waste from the collieries out to sea and dumping it on the Goodwin Sands. Apart from the enormous expenses involved by such a scheme, the effect on the tides and currents in the Straits of Dover would probably have been disastrous.

Geology.

Coalfields may be classified under three headings: those which have been developed from the initial working of an outcrop of the coal measures; those which adjoin known coalfields but which, through the super-position of unconformable younger beds of rock, are completely hidden, and those which lie near no known coalfields and which are completely covered by an unconformable capping of newer rocks. The Kent field belongs to the last of these classes and is of particular interest as it is the only coalfield of this type being worked in the British Isles, and as a result, the methods of its exploitation and the history of its development have differed considerably from those of any other coalfield.

The geology of the Wealden area, for long considered simple, has, on exploration of the underground structure, proved to be extremely complex. In place of a simple succession of strata, the Wealden anticline is shown to be superimposed upon a great syncline of Mesozoic rocks, which in their turn rest unconformably upon the Palaeozoic floor. The wedging out of the Lower Cretaceous and Jurassic strata to the N. and E., due both to the attenuation of individual beds in that direction and to the presence of unconformities at various horizons, causes the Palaeozoic floor, with its associated coal measures, to lie at no great distance from the surface in SE. Kent.

Tectonically the coalfield forms one of the series of coal-basins extending from Westphalia, through N.France to S.Wales and possibly S.Ireland, which are associated with the Armorican system of E-W folding. These basins are generally bounded on the N. and S. by folds of the system and the Kent basin seems to conform to this general rule, the presence of such a fold, with an ESE - WNW trend having been proved to the N., while a certain amount of evidence points to a southern fold lying under the English Channel.

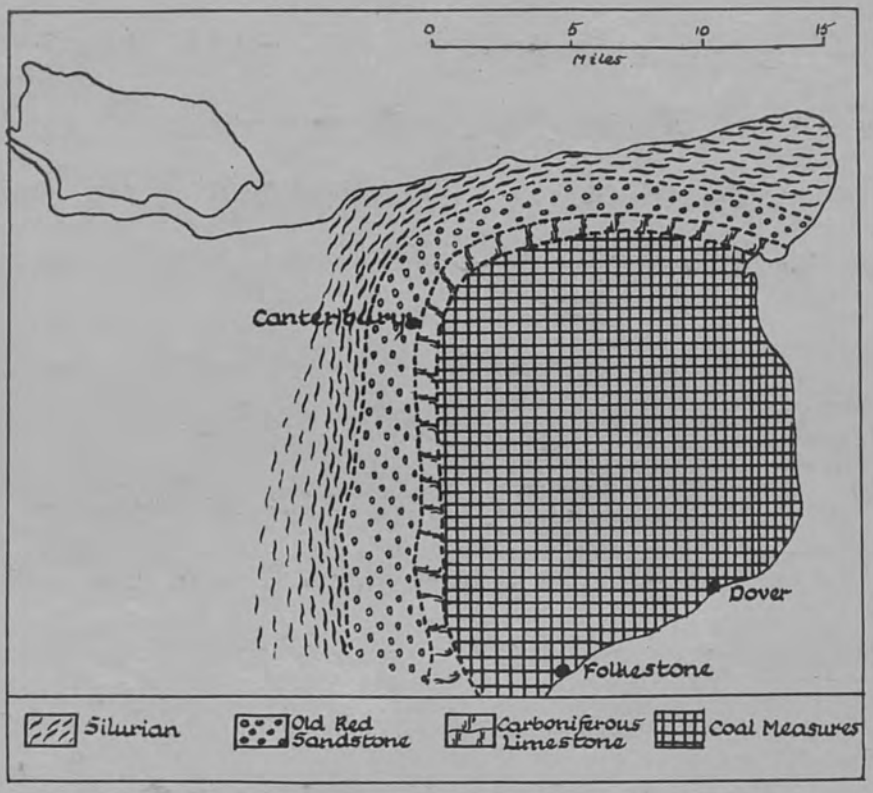
Minor folds of varying direction were associated with the main E-W flexures and in this region, the general rise of the Palaeozoic floor from W-E points to the presence of a N-S anticline beneath the Straits of Dover, against which the carboniferous rocks terminate. The presence of this anticline has an important bearing on the question of the continuity of the Kent coalfield with that of the Pas-de-Calais, a much disputed problem. The sheet of coal measures may at one time have been continuous - there is insufficient evidence to prove this point - but the major folding of the region took place after the deposition of the coal-measures, and the existing evidence, derived from the Ripple, Maydensole, and Oxney borings, in two of which the Carboniferous Limestone has been reached and also from palaeobotanical evidence which points to a thinning of the Coal Measures to the S. and E., shows that the E. boundary lies probably not far out to sea, and the

coalfield, therefore, to be separate from that of the Pas-de-Calais.

The basin, then, occupies a syncline on the W. flank of a N-S anticline. The N. boundary has been well-defined by borings. At Ebbsfleet the Carboniferous Limestone was reached at 1149 ft. - OD, after proving only 103 feet of Coal Measures; at Chitty at 1125 ft - OD and at Beltinge both Coal Measures and Carboniferous Limestone were absent, the Gault being underlain by Silurian rocks. At Herne Bay a boring showed Gault resting on a series of strata whose identity was doubtful, some authorities maintaining they were coal measures. They are now generally regarded as Devonian. (see map Fig.8 for location of boreholes.)

The E. limit has already been discussed. Dr Arber concluded that it lay not less than 4 and not more than 8 miles to the SE. of Oxney. The S. boundary has not been proved, but the same authority estimated that, if the basin be symmetrical, it lies at least 8 miles, possibly much more to the SW. of Dover and Folkestone.

Dr Arber considered that the W. boundary of the field was formed by a great fault, being of the opinion that between the area of the proved coalfield and the Brabourne-Chilham line (where the Mesozoic strata rest on Pre-Carboniferous), there was insufficient room for the Coal Measures and the Carboniferous Limestone to crop out and that these, therefore, were



SKETCH MAP OF THE PALÆOZOIC STRATA PROVED AT VARYING DEPTHS IN EAST KENT. From "NATURE" 1929.

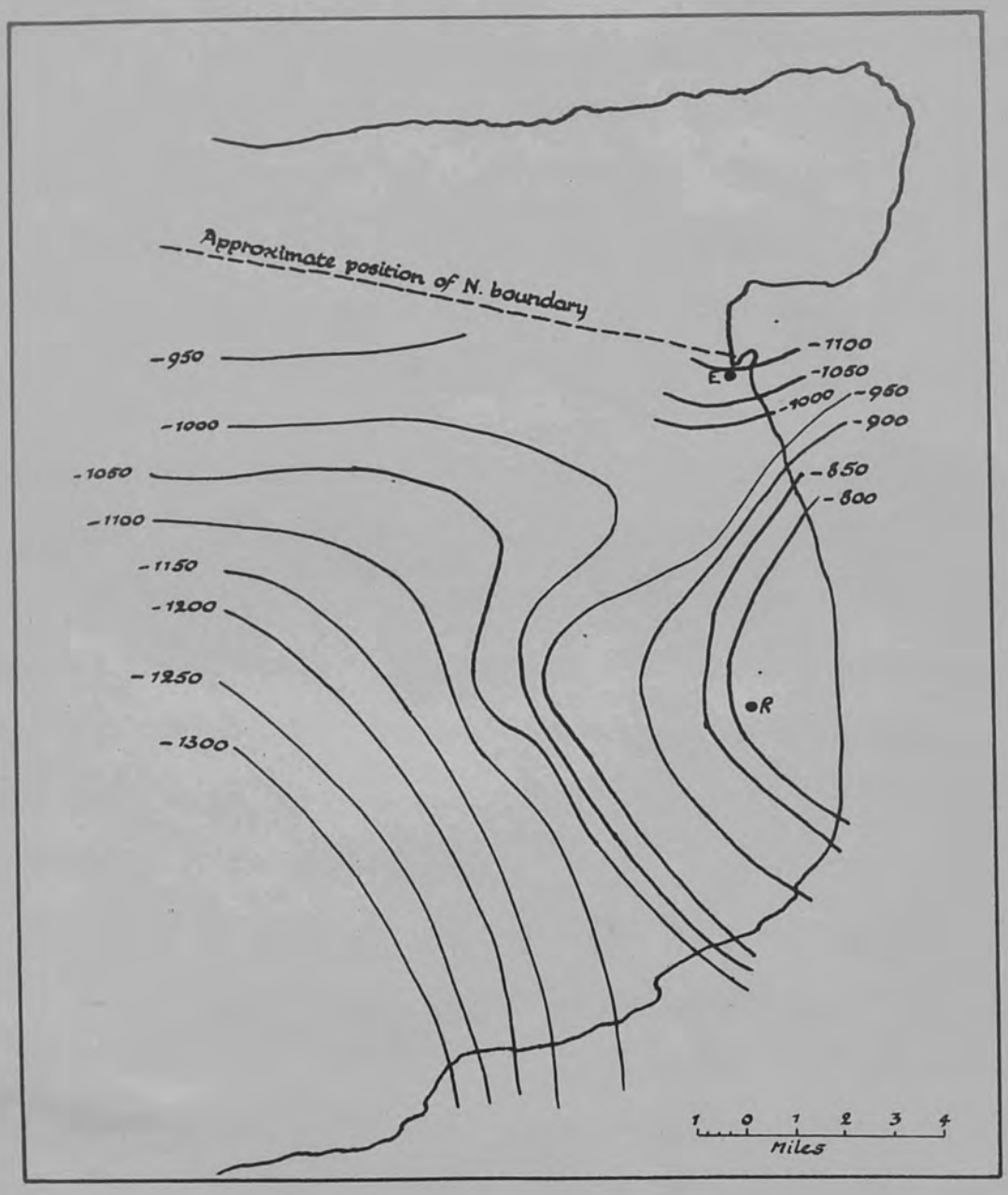
Fig. 9.

probably faulted down into Devonian. Subsequent borings, however, have proved Carboniferous Limestone underlying the Lias at Harmansole and beneath a thickness of only 691 ft. of Coal Measures at Elham, and investigation has shown that the basin is complete on the W. and is bounded by an outcrop of Carboniferous Limestone (see Fig.9).

The period of uplift, folding and denudation which supervened after the deposition of the carboniferous rocks, resulted in the formation of a gently undulating platform sloping generally SW. and W. and reaching its highest elevation (- 800 OD) in the E. near Ripple and falling to below - 1700 ft. at Brabourne (see Fig.10). The planation of this Palaeozoic platform probably continued through Permian and Triassic times (slightly interrupted by deposits in the Brabourne region) but was partly interrupted by the deposition of the Lias over the SW. part of the region and subsequently much more completely by the Jurassic rocks (see Figs. 11 and 12). In the N. however, where, at the Ebbsfleet boring, the Palaeozoic rocks underlie Weald Clay, it only ceased with the deposition of lower Cretaceous rocks.

The underground structure of the region is shown in the transverse sections, Figs. 13 and 14.

The principal and most extensive unconformity will be seen to occur at the base of the Wealden series, which overlie



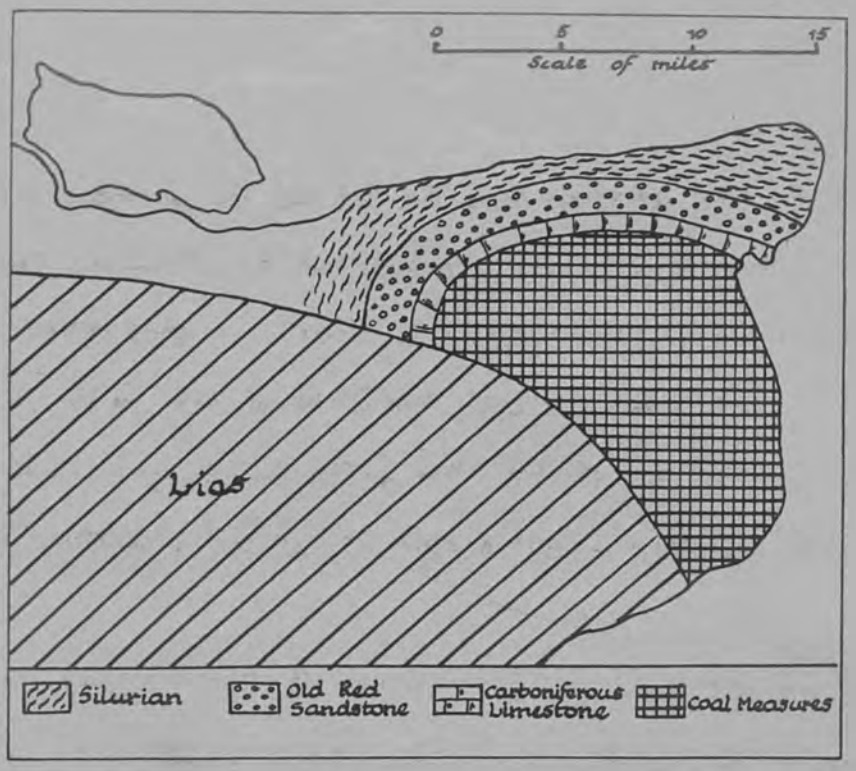
CONTOUR MAP OF COAL MEASURES. Measurements of depth indicated in feet below Ordnance Datum. From Trans. Institute Mining Engineers. Vol. 47

Fig.10.

Note: (1) The ridge of high land in the E. in the neighbourhood of Ripple (R) and Deal.
(2) The gradual but rapid lowering of elevation on the W. and SW. by some 500 ft. in a distance of 8 miles.
(3) Evidence of low-lying ground at Ebbsfleet (E) on the NE. and rapid rise up to the Deal plateau.
(4) Indications of a rise on the NW. towards Canterbury.

Fig. 11.

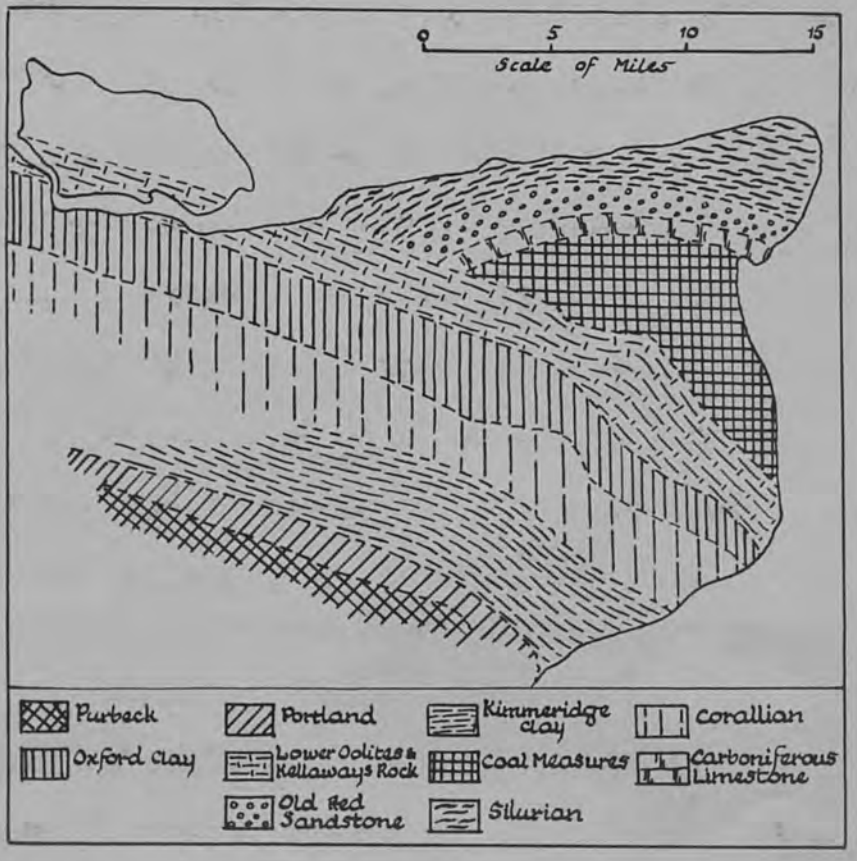
Fig. 12.



SKETCH MAP TO SHOW THE DISPOSITION OF THE LIAS ON THE PALÆOZOIC FLOOR IN EAST KENT

From "Proc. Geol. Assoc." 1930

Fig.11.



SKETCH MAP SHOWING THE DISPOSITION OF THE JURASSIC STRATA ON THE PALÆOZOIC FLOOR IN EAST KENT

From "NATURE" 1929.

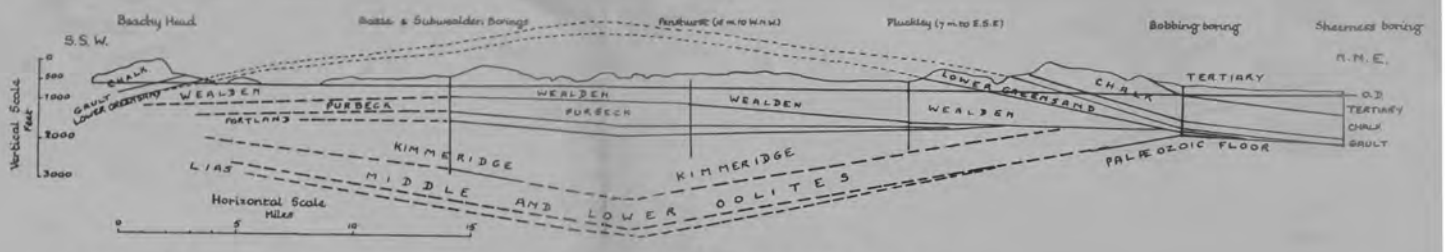
Fig.12.

the complete succession of Jurassic rocks, except the Lias and Trias, which are overlapped by Oolite, and which rest in the N. on the Palaeozoic platform. The second unconformity lies at the base of the Oolites which rest on the Palaeozoic floor in the N. where the Lias thins out, and the third at the base of the Lias which overlaps the Trias considerably in the N. part of its range.

The general attenuation of the strata to the N. and E., which accentuates the wedge-structure of the rocks, is due to the fact that accompanying the general earth movements affecting the whole region, there was a persistent downward movement of the Palaeozoic rocks beneath the centre of the Weald together with stability and a possible uplift on the flanks. This resulted in the deposition of a great thickness of sediments in the centre of the basin and when later, towards the end of the Upper Cretaceous period, a stretching movement took the place of the sag, the central part where the sediments were thickest bulged up to form the Wealden anticline.

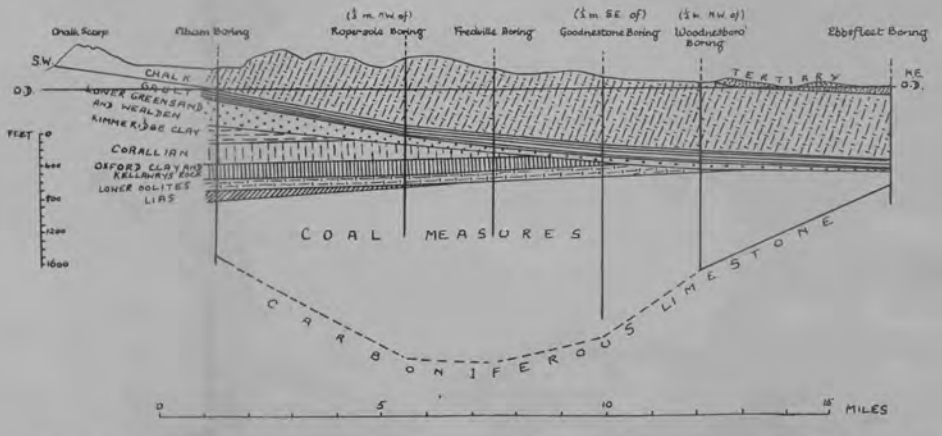
A boring put down at Battle showed an upward rise of the Jurassic strata to the S. of the Weald and suggests that the general underground structure proved in the N. may repeat itself in the S.

The area of the field which may be worked profitably, and the reserves of coal have been variously estimated. The Royal



DIAGRAMMATIC SECTION FROM SHEERNESS TO BEACHY HEAD TO ILLUSTRATE THE STRUCTURE OF THE WEALD

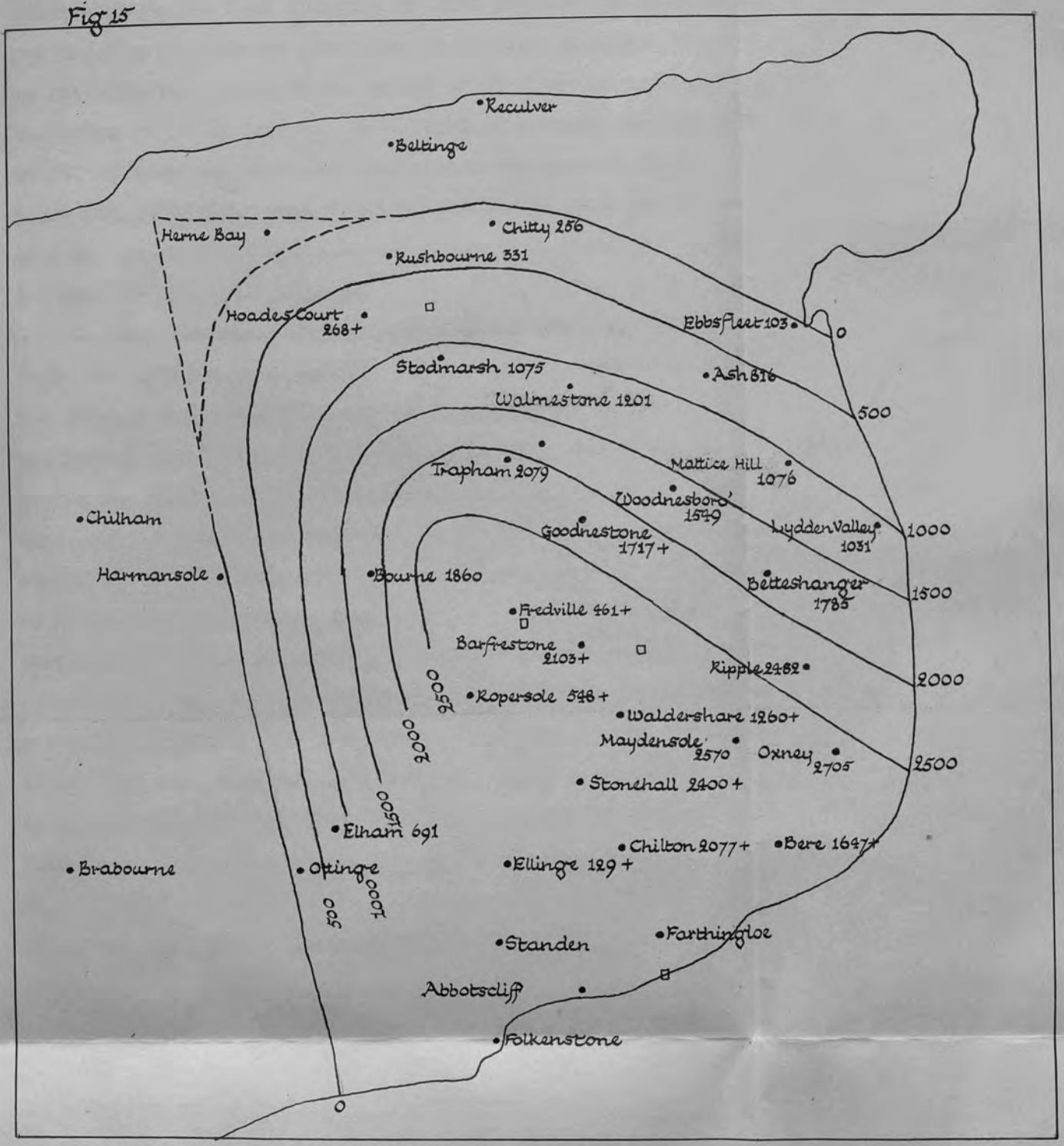
Fig.13.



SECTION FROM EBBSFLEET TO ELHAM SHOWING THE UNDERGROUND STRUCTURE. THE JUNCTION OF THE COAL MEASURES AND THE CARBONIFEROUS LIMESTONE BENEATH THE CENTRE BORINGS IS APPROXIMATE.
Based on a Geol. Survey Section.

Fig.14.

Fig 15



SKETCH MAP OF COALFIELD SHOWING THICKNESS OF COALMEASURES

by means of Isopachytes and insertions of thicknesses proved in the borings: + after a number signifies that the Measures were not completely penetrated. All measurements in feet.

From "Iron and Coal Trades Review" Dec. 1920.

Commission on the Coal Industry of 1905 ventured no opinion and the first estimates came from Dr Strahan in 1912. He gave, as the workable area, 150 sq. miles on land and an undersea extension of 56 sq. miles. He assumed an average thickness of 10 ft. of workable seams and calculated the reserve to be 2,000,000,000 tons. This estimate related to coal in seams of 1 ft. or over in thickness and lying at a depth not exceeding 4000 ft. from the surface.

In 1915 Professor Jevons published an estimate in his work "The British Coal Trade". He considered that Dr Strahan had grossly underestimated the reserves and put the area of the proved field, including a four-mile extension seaward, at 250 sq. miles with an average thickness of 25 ft. of workable coal, giving a reserve of 6,000,000,000 tons. He further supplemented this figure by a probable extension of the field 10 miles W. of Canterbury and 1 mile in each of the other directions, giving an additional area of 150 sq. miles representing 3,600,000,000 tons and making the grand total of proved and probable reserves 9,600,000,000 tons. It should be noted, however, that the W. extension of the field beyond Canterbury is unlikely since the Coal Measures are absent at Harmansole and Herne Bay, and an extension of the area on the SW. by a mile would not contain an average of 25 ft. of coal since all the borings on this boundary show but poor thin seams.

Dr Strahan's average thickness of 10 ft. is, however, very much below the proved figure since many boreholds have shown a thickness of over 35 ft. of coal while at the Stonehall boring some 96 ft. were proved in seams over 3 ft. thick.

Before the Coal Commission of 1925, the area of the field was given as 250 sq. miles, of which 105 were estimated to contain 1,300,000,000 tons in seams of 3 ft. and over and within 3,000 ft. of the surface, i.e. coal which may be economically worked under existing methods in competition with other areas.

The following table shows the reserves of other coalfields in England and Wales estimated by Dr Strahan in 1912, on a basis of seams of 1 ft. and over in thickness lying at a depth of not more than 4,000 ft. from the surface.

TABLE VII.

Coal Reserves in England and Wales.

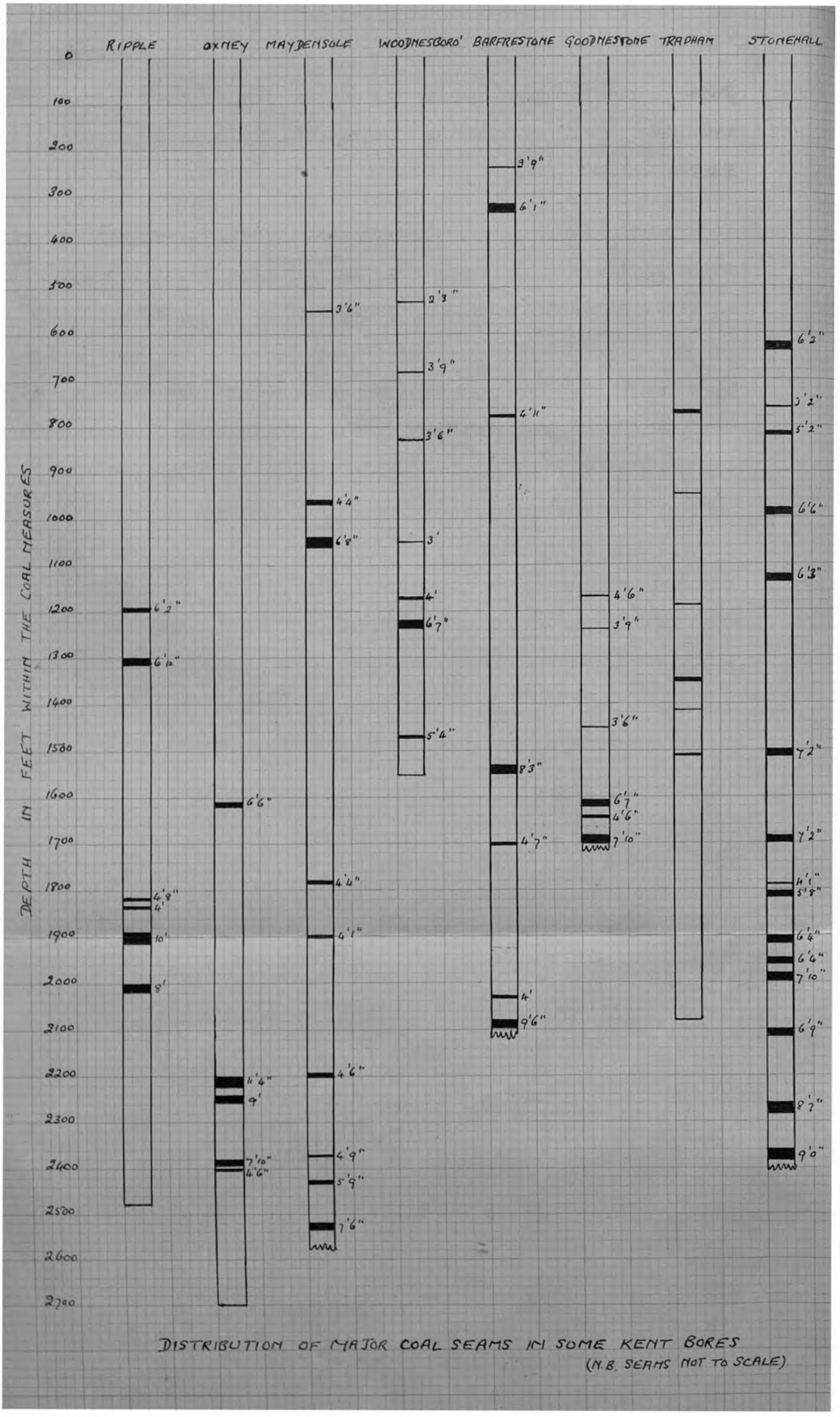
District	Area in sq.miles	Actual Reserves in tons.
Yorkshire,Derby & Notts	1376	39,620,000,000 (in addition,probable reserves in this field of 14,853,600,000)
South Wales	822	32,500,000,000
Northumberland & Durham	849	10,850,000,000
N. & S. Staffs.	167	7,147,000,000
Lancs & Cheshire	554	5,500,000,000
Bristol & Somerset	258	4,200,000,000
N. Wales	179	2,496,000,000
Leicester	84	2,455,000,000
Cumberland & Westmoreland	253	2,152,000,000
Warwick	56	1,423,000,000
Salop & Worcs.	98	359,300,000
Forest of Dean	28	196,700,000

Taking Professor Jevons' figure of 6,000,000,000 tons reserve for Kent as being most likely, though possibly a little conservative, the field is seen to occupy a high position with

Fig.16.

N.B. (1) Tendency for seams to occur in 2 groups, an upper and a lower.

(2) Tendency for seams in lower group to be more numerous and thicker.



DISTRIBUTION OF MAJOR COAL SEAMS IN SOME KENT BORES

(N.B. SEAMS NOT TO SCALE)

regard to other deposits in the country, having the largest reserves of all the smaller fields with the exception of the Staffordshire field.

There have been various opinions on the classification of the Coal Measures in Kent. Dr Arber, basing his conclusions on palaeobotanical evidence, related them to the Transitional and Middle Coal Measures. Dr Bolton, on faunal and lithological evidence divided them into an Upper and a Lower Series. The Upper he related to the Middle Coal Measures and the Lower to the Lower. Subsequent investigation seems to support Dr Arber's conclusions, though there is a possibility that the Lower Coal Measures may be represented in a few thin seams. Everywhere the millstone grits are absent.

The correlation of the seams met with in the various borings is made very difficult by their marked tendency to split as they are traced laterally and to vary greatly in thickness from point to point.

Lithologically, they fall into two groups. An upper, marked by the presence of thick beds of sandstone and bands of shale; the seams here are numerous but not very thick and in this group lie the seams being worked at Tilmanstone and formerly at Snowdown. A second, lower group lies towards the base of the Middle Coal Measures and consists principally of shales and fine clay with numerous coal seams. Here occur the thickest seams in the field, occurring often in groups of

three or four close together, and often 11 ft. or more in thickness. The two groups are separated by a series either barren or containing but thin seams of coal. As a result of this distribution of the seams within the Coal Measures, the collieries work at a depth of either about 1500 ft. or about 3000 ft.

Types of Coal.

From the schedule of analyses of seams of 3 ft. and upwards in thickness, from various borings[1], it will be seen that all types of bituminous coals occur. On the whole they tend to be low in volatile matter and therefore make better steam coals than house coals, but the range is complete from a highly bituminous coal proved in the Waldershare boring, suitable for gas manufacture, to the best quality smokeless navigation steam coals, "admirably suited for general furnace work and slow-combustion stoves. It contains fully 92½% of heat-producing elements and moderate amounts of ash and sulphur. It will burn freely and will leave an ash which will not flux into a hard clinker. In every respect, therefore, the coal is one of high commercial value". (Analyst's note on the 10 ft. seam at 2,800 ft. in the Ripple boring)

Iron Deposits.

During the exploration for coal, ferringinous strata were found to occur at 3 or 4 separate horizons in the Jurassic rocks. Bands of possible economic importance occur in the

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(1) See Table 1 of Appendix.

upper part of the Corallian series and, at a greater depth, in the Kellaways rock. The first of these is the more important and forms, in the neighbourhood of Dover where it is best developed, an iron ore bed at a depth of 600 ft. from the surface consisting of "shining brown globules of iron, thickly crowded in a loamy matrix". Here it is 9 ft. thick but deteriorates in thickness and quality in its landward extension from Dover. At Abbotscliff it is only about 8 ft. thick, at Folkestone it is degenerated to a brownish marlstone and at Elham it has thinned out entirely. The area over which it is considered workable has been estimated at 6 sq. miles with an average thickness of 9 ft. of good ore representing approximately 100,000,000 tons of ore. The following analysis shows it to rank comparatively high, among British ores, in iron content.

Water	10·16%
Metallic iron	32·94%
Silica	14·96%

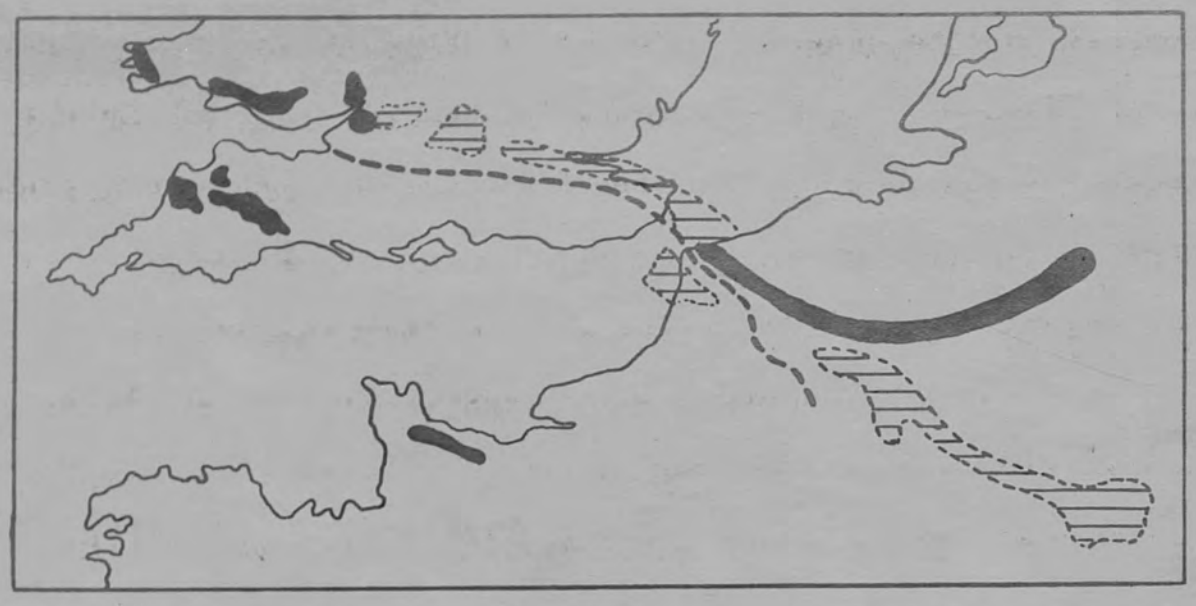
The Kellaways rock deposit, which has not been so fully investigated, is better developed to the N. and may locally contain beds suitable for economic development, but an abundant mixture of glauconite and sandy matter which it contains may prevent its use. It is very variable in composition, specimens from the Fredville boring yielding 34·59% of iron, and others only 21·10%.

The approximate boundary of the total area of possibly workable deposit is shown on the map, Fig. 8 and the best deposits, the Corallian, occur conveniently at or near the coast, i.e., they are well placed for admixture with imported ores should a smelting industry ever develop.

A short history of the discovery and development of the coal-field.

The story of the development of the Kent coalfield is one of continued persistence in the face of first incredulity and, later, but poor support, even active hostility on the part of the public. In the initial stages it proved difficult to win the support of expert opinion to the view of the existence of the Coal Measures, and after the establishment beyond dispute of that fact, the development of the field has been extremely slow and extremely costly. A completely hidden coalfield, necessitating as it does, the sinking of a large number of boreholes to establish underground conditions, is naturally the most expensive class of field to develop, but, in addition, the sinking of the shafts met in most cases with difficult geological conditions owing to the heavy water-bearing nature of certain formations and was further hampered by the unfamiliarity of mining experience in this country with Cretaceous rocks.

The physical identity of the coal districts of Somerset and Northern France had been recognised by Buckland and Conybeare as far back as 1826. In 1855 Godwin-Austen read his classic paper before the Geological Society of London in which he traced the course of a ridge of old crystalline rocks, extending either bare or overlain by Secondary and Tertiary deposits from the valley of the Ruhr, by Aix-la-Chapelle,



Map of the possible extension of the Coal Measures: after Godwin-Austen.

Coal Measure tracts

Probable extension of Coal Measure tracts

----- Axis of Artois

Fig.17.

Note. Suggested position of concealed coalfield along the Thames Valley.

through the Ardennes and the S. of Belgium by Liège, Namur, S. Valenciennes, and continued in the old Axis of Artois, underlying the present chalk axis of elevation, and bending westward beneath the Weald, through the Mendips, eventually appearing at the surface in the old rocks of the Pembroke region.

He brought forward a considerable body of evidence to support the theory of the continuity of the Belgian Coalfield beneath the SE. part of England, and placed the probable extension of the Coal Measures on the N. flank of this buried mountain range.

He reached the following conclusions:

(1) That the physical configuration of W. Europe at the Upper or true Coal Measure period indicates the probable continuity of a band of the littoral coal growth from the Midland and S.W. parts of England to the S. of Belgium.

(2) That there may also exist a lower stage of coal-deposits, extending somewhat W. of the Boulonnais and of equal value.

(3) That the influence of the old axis of flexure on the distribution of the Oolitic and Cretaceous groups favours the presumption that there are no very thick series of overlying strata interposed between the coal-measure series and the present surface.

(4) The Upper Coal Measures may be regarded as occupying a line on the N. of the Weald denudation, or conforming generally

to the direction of the valley of the Thames whilst the lower series may occur on a line coincident with the N. chalk escarpment of that denudation[1].

The accuracy of most of these deductions has since been proved, but at the time the paper was received somewhat sceptically. In 1866, however, the Coal Commission expressed a view that steps should be taken to determine directly the underground formation in SE. England.

In 1872 the Sub-Wealden Exploration Society was formed, whose object it was to determine the depth of the Palaeozoic platform beneath the Weald. A site for a borehole was chosen at Netherfield near Battle where the oldest rocks exposed in the Weald form the bottom of a valley. The boring, carried out with great difficulty and considerable expense, was abandoned at a depth of 1905 ft. and showed the following section.

Purbeck beds	200 ft.
Portland "	57 "
Kimmeridge Clay	1073 "
Corallian beds	515 "
Oxford Clay	60 "
	1905

Godwin-Austen had maintained that the site chosen was too far S. and the boring showed a thinning of the strata to the N. which suggested a greater chance of success in that direction

(1) Proc. Geol. Soc. June 1855.

evidence which received support in 1876 from a boring at Meux's brewery in Tottenham Court Road where Devonian rocks were struck at depth of 1,000 ft. beneath 64 ft. of Great Oolite directly underlying the Gault.

A sub-committee of the Sub-Wealden Committee, comprising Godwin-Austen, Ramsay, Prestwich and Evans recommended boring in the neighbourhood of Dover or just S. of Canterbury, where they considered the Chalk and Gault would be found to be not more than 700-1000 ft. thick. This forecast was to prove marvellously accurate as in none of the borings made later was their limit of 1000 ft. exceeded. At the time, however, no more funds were available and the matter lapsed.

In 1886, the plant and labour of the Channel Tunnel boring was rendered idle by the Government veto on the scheme and the engineer of the enterprise, Brady, in consultation with Professor Boyd-Dawkins, suggested that they should be utilised for a boring for coal.

A site was chosen near the Channel Tunnel shaft on the W. side of Shakespeare Cliff and a shaft sunk to a depth of 44 ft. and a borehole put down from the bottom. The Coal Measures were struck at a depth of 1157 ft. from the surface and a seam of good blazing coal 20 ft. lower.

The section of the borehold was as follows:-

Grey Chalk and Chalk Marl	174 ft.
Chloritic Marl	8 "
Gault	121 "
Lower Greensand, Wealden and Hastings beds	241 "
Oolites and Lias	613 "
Coal Measures with 8 workable seams 2-4 ft thick.	1173 "
	2330 "

Coal in Kent was now an established fact, but nothing further was done in the matter until 1896 when a private syndicate began the pit at the foot of Shakespeare Cliff on the slope of chalk scree just above the beach.

It would be out of place here to give any account of the numerous companies formed and reformed from time to time and the extremely complex financial operations sometimes of a somewhat doubtful nature, by means of which the field was exploited and finally developed. It is sufficient to say that from the start, the enormous expenses attendant upon the opening-up of this type of field was not appreciated and until recently all the enterprises have suffered from a lack of capital, and, as a result, the work of boring and sinking was constantly held up for long periods whilst funds were raised. It proved very difficult to gain the support of a sceptical public and early failures and disappointments did not help matters. In 1909 the Press declared the Kent coal enterprise

as "unsuccessfully terminated" and in addition the development has taken place during an unfortunate period of economic history. When the early collieries were beginning to attain a commercial output, the war intervened and seriously depleted their labour supplies, and the post-war depression in the coal industry has naturally had serious effects on the exploitation of a new region.

There have been both German (Westphalian) and French (Pas-de-Calais) interests in the field. French interest still persists in the Waldershare area, though not at the moment active, but the German connections were severed on the outbreak of war.

Table VIII shows the main borings put down to explore the field.

The Brady borehole is, historically, of greatest interest. The Coal Measures were not completely penetrated but a total thickness of 23 ft. 5 in. of coal was proved in 12 seams, and an ironstone bed 12 ft. thick at a depth of 546 ft. in the Kimmeridge series was found. Many of the coal-seams were seen to be floored by fire-clays of a good quality which gave rise to the hopes of a possible pottery industry similar to that of the Potteries coalfield.

The Brabourne boring, though commercially disappointing, proved of great scientific interest. It was sunk to 2010 ft.

TABLE VIII.

Main Borings for Coal in Kent.

Year when started	Year when finished	Borehole + O.D. in ft.	Total depth in ft.	Depth at which Coal Measures were entered - O.D. in ft.	Depth at which Carboniferous Limestone was entered - O.D. in ft.	Total thickness of Coal Measures proved.
1886	1890	Brady 50	2330	1107		1173
1897	1899	Ropersole 400	2129	1180		548
1897	1898	Brabourne 215	2010	-	Devonian at 1710	-
1898	1899	Ottinge 300	836	-	-	-
1902	1902	Elling 400	1805	1276	-	129
1905	1907	Waldershare 335	2654	1059	-	1260
1905	1907	Fredville 259	1836	1116	-	461
1906	1910	Goodnestone 136	2902	1052	-	1714
1907	1912	Barfrestone 193	3327	1031	-	2103
1908	1913	Walmestone 74	2286	1002	2203	1201
1908	1909	Woodnesboro' 53	2631	1017	2566	1549
1909	1912	Mattice Hill 11	2075	964	2040	1076
1910	1911	Stodmarsh 87	2262	979	2054	1075
1910	1911	Trapham 59	3224	1065	3144	2079
1910	1911	Maydensole 253	3765	942	-	2570
1910	1912	Oxney 138	3742	859	3564	2705
1910	1911	Bobbing 120	1260	-	Silurian at 1070	-
1910	1911	Chilham 40	1154	-	Silurian at 1052	-
1911	1911	Ripple 63	3376	808	3290	2482
1911	1912	Stonehall 221	3691	1070	-	2400
1912	1912	Ebbsfleet 10	1389	1046	1149	103
1912	1913	Lydden Valley 11	2027	928	1948	1031
1912	1913	Chislet 50	2901	988	1554	566
1912	1913	Chitty 5	2015	869	1125	256
1912	1913	Rushbourne 65	2490	1069	1400	331
1912	1913	Chilton 160	3346	1109	-	-
1913	1914	Bourne 185	3235	1320	3180	1860
1913	1913	Beltinge 120	1964	-	Silurian ? at 1100	-
1913	1913	Hoades Court 140	1360	952	-	268
1913	1913	Ash 25	1966	1064	1880	816
1913	1913	Betteshanger 95	2930	1012	2797	1785
1913	1915	Bere 396	3005	962	-	1647
1913	1913	Abbots Cliff 87	777	-	-	-
1913	1915	Standen 300	1076	-	-	-
1914	1914	Reculver				
1914	1914	Harmansole 200	1730	-	1049	-
1914	1915	Elham	2346	1323	2014	691
1914	1914	Farthingloe 230	801	-	-	-
1915	1916	Folkestone 113	3400	1374	-	1913
1922	1923	Adisham 133	3265	1079	3104	2025

and ended in Devonian strata without having pierced the Coal Measures. This helped to determine the SW. boundary of the field, since coal was proved along the Ropesole-Dover line, and the boundary was later more exactly located by the presence of Coal Measures, but no coal at Ellinge.

The Waldershare boring was important. It disclosed 4 thick seams of valuable coal; the "Welcome" 1 ft. 8 in.; the "Alexandra" 3 ft. 4 in.; the "King Edward" 4 ft. 6 in. and the "Rockefeller" 5 ft. 2 in., and, in addition, a reduction of the Mesozoic strata between the base of the Gault and the Coal Measures from 842 ft. at Dover to 414 ft., thus showing the rise in the Palaeozoic floor to the N., a rise, subsequently confirmed by evidence from various other borings. Valuable coal seams were struck in the Goodnestone and Barfrestone bores. The more northerly bores of Walmestone, Woodnesborough, Mattice Hill, Stodmarsh and Trapham, showed an absence of the Oolites and an attenuation of the Wealden beds; in each the Carboniferous Limestone was reached at depths varying from -2566 ft. O.D. to - 2040 ft. O.D. and thus gave more evidence of the northerly rise of the Palaeozoic floor. The Oxney and Ripple borings disclosed a great thickness of Coal Measures containing good thick seams, the 10 ft. seam of smokeless steam coal at 2800 ft. in the Ripple boring being probably one of the best in the field.

Many of the boreholes have already been discussed in connection with the boundaries of the field.

Certain borings in the neighbourhood of Folkestone were put down primarily to prove the iron deposits of the region.

The boring activities stretched over a long period, the Brady borehole being started in 1886 and the last bore, the Folkestone, being finished in 1917. The sinking of the pit shafts, and the ultimate production of coal on a commercial scale has occupied a correspondingly long time.

The Shakespeare pit commenced sinking in 1896 with inadequate apparatus and no very complete knowledge of the strata to be encountered. It was down to 366 ft. and then drowned by an inrush of water from the Lower Greensand. In 1897 the water difficulties were overcome and sinking was resumed, but a second inrush of water and silt from the Hastings beds caused the pit to be abandoned. A second pit, the Simpson pit, had been started in 1896 - without pumps in spite of the water difficulties already experienced in No.1 pit, and this, too, was flooded at 303 ft. Pumps were installed and by 1901 a depth of 1,100 ft. was reached when an accident to the pumping machinery caused flooding again. The pit was cleared and by 1903 the shaft had penetrated 120 ft. into the Coal Measures but in 1907 the pit was again flooded, this time from a sandy bed in the Coal Measures. The pit was drained and sinking restarted and on April 30th, 1912, 12 10-ton wagons of coal were dispatched to various works for testing purposes. This was the only considerable quantity of coal ever produced from this

colliery. Meanwhile a third pit was being sunk on the site of the Brady borehole. The sinking was spasmodic with flooding at various points and in 1914 a depth of 1632 ft. was reached. During the sinking a considerable quantity of iron ore was raised and sent N. for testing purposes. N. country iron-masters had already been attracted to the area and in 1917 the whole of the Shakespeare Cliff undertakings were acquired by the Channel Steel Company. The pits were subsequently plugged above the water-bearing strata and it is possible that they may be worked for iron ore at some future date.

Two pits had been started in 1906. One, the Guilford pit, started near the Waldershare borehole with two shafts. Work was very slow because of transport difficulties until the East Kent Light Railway was brought up to the pits in October 1912. The war caused a cessation of activities but sinking was resumed in 1919 only to be abandoned later.

The other, the Tilmanstone pit, was the first to be developed successfully. It suffered, like Guilford, from bad transport conditions. The nearest rail was 3 miles away and no real progress was possible until rail connection was made. In 1911 water difficulties brought sinking to a standstill. A second shaft, the "Gabrielle" had been started in 1907 and here also much difficulty was experienced. The pit was flooded from the Hastings beds and the infirm nature of the strata caused

great constructional difficulties. The sinking through the Oolites met with no hindrance, but an unexpected inrush of water at the head of the Coal Measures caused flooding and work came to a standstill. A third pit had meanwhile been sinking and this too met with similar water difficulties. To deal with these abnormally difficult water conditions electrical pumping plant was installed, and sinking resumed, and in 1912 all three pits reached the Coal Measures. No.III pit entered a 5 ft. seam in 1913 and this, the "Beresford" seam is still being worked. It lies at 1560 ft. below the surface and is somewhat spoiled by a parting of stone which has to be picked out by hand.

Analysis of 5 ft. "Beresford seam" (Dry Basis).

Volatile Matters	22·12
Fixed Carbon	68·69
Sulphur	2·30
Ash	5·87
Water	1·02
	100·0
Coke per ton of coal	75·16
Calories	7609

Its chemical properties are good but its friability makes it unsuitable for household purposes (only 30-40% large coal is obtained) and in an endeavour to reach a seam of good hard household coal, a shaft has been carried down to 3,000 ft. It is, however, unlikely at the present time that the expense necessary to sink a second shaft to this depth in order to work the coals, will be incurred.

In 1908 Snowdown colliery started sinking on a site near the Fredville boring. Profiting by the difficulties encountered at Tilmanstone the company started better equipped but no serious geological difficulties were met with as the Hastings beds in this locality proved to be a solid conglomerate. The Coal Measures were entered in 1912 and in 1913 the "Beresford" seam, here 4 ft. 4 in. thick, was struck. Sinking was recommenced in an effort to produce a suitable domestic coal and in 1915 the 4 ft. 7 in. seam of the Barfrestone boring was reached. This, the "Snowdown Hard" lies at 2,236 ft. is a hard bright coal and was worked for a period. In 1917 the 4 ft. 5 in. seam was reached at 3,007 ft., and this the "Millyard" seam is at present worked. The seam has no partings and is composed as follows:

Volatile matter	20·97%
Fixed Carbon	75·65"
Ash	2·55 "
Moisture	0·83 "
	100·00

Calories 8606 B.T.U. 15,490.

It is a very high grade steam coal, comparing favourably with the best South Wales steam coals.

Development at Snowdown was interrupted by the war. Later in 1924 the colliery was acquired by Pearson & Dorman Long Ltd., and reorganised. The shafts were enlarged and the second shaft

sunk to the Millyard Seam, and production has increased steadily.

In 1911, the exploration of the N. part of the field commenced and the sinking of the Chislet shaft began in 1913. No very great difficulties were encountered as the Wealden series have here practically disappeared and the only trouble came from the loose Tertiary sands and the fissured Upper Chalk. In 1918 the shafts entered a good clean 5 ft. seam at 1350 ft. which is now being worked. This is primarily a manufacturing and coking coal, and though it may also be used for household purposes it suffers from friability.

Betteshanger was the last pit to be sunk. It was started in 1923 by Pearson & Dorman Long Ltd., and being well equipped, it made rapid progress and a good seam is being worked at 2400 ft. and household, coking and manufacturing coals are produced.

In the early days of exploitation, a rapider and more extensive development of the field was looked for. The location of 8 pit-heads was determined and besides the existing collieries and the disused Shakespeare Cliff working, other pits were started at Guilford (already mentioned), Stonehall, Wingham and Hammill, the last three consisting of little more than surface workings when they were abandoned.

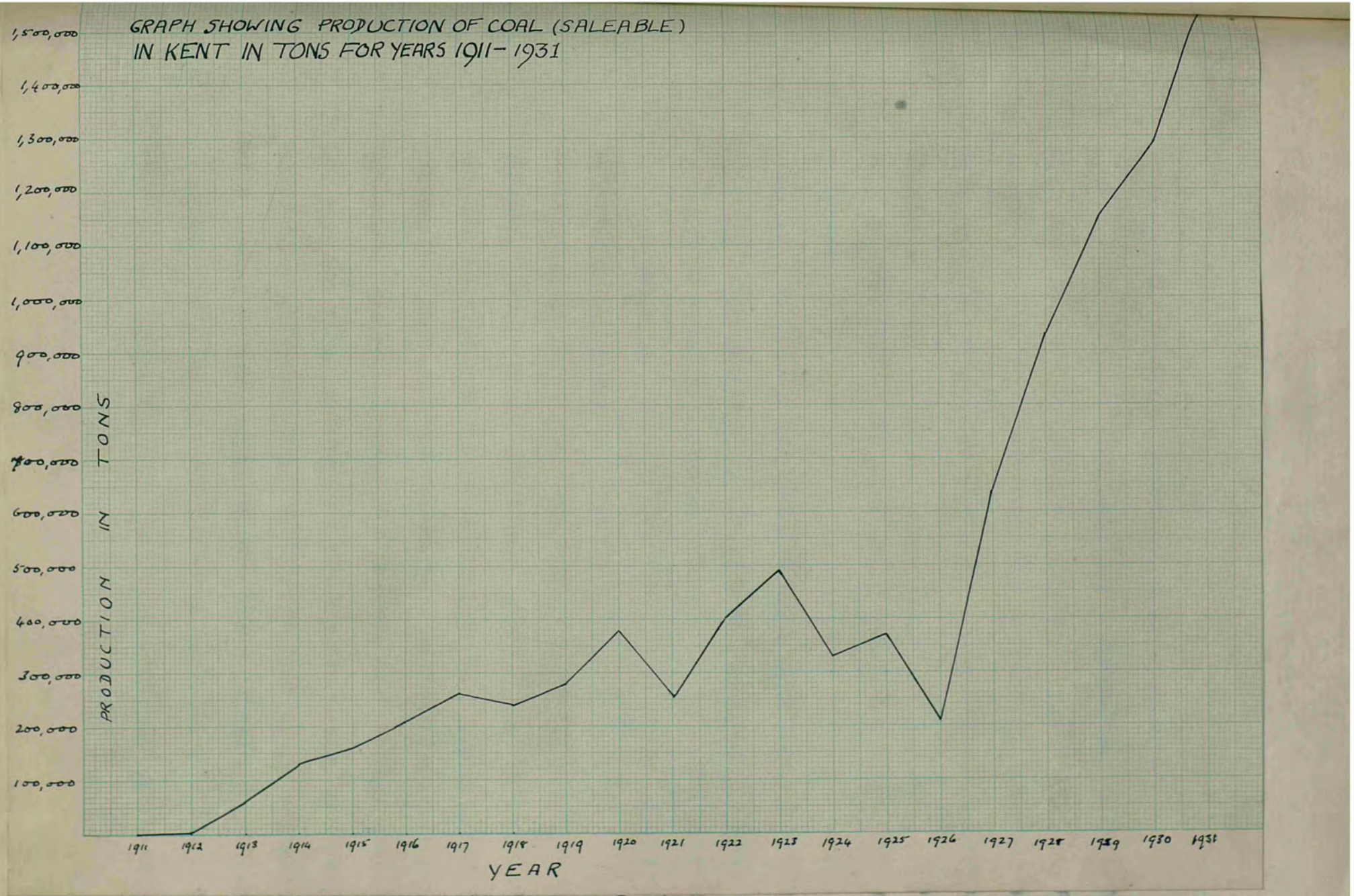


Fig. 18

Note: 1921 and 1926 were coal-strike years, and in 1924 Snowdown Colliery was closed.
Figures from Annual Reports of the Secretary for Mines.

Output.

The total annual production of coal in Kent and the annual output at each colliery are shown in Figs 18 and 19. The rapid rise in total production since 1926 is attributable to the opening of Betteshanger, the reopening of Snowdown and increased production from Chislet and Tilmanstone. The following table giving the output of coal at the smaller coalfields for 1931 (for the complete table of coal output in England and Wales in 1931, see Appendix, Table 2), shows that Kent production is already higher than that of many of the small fields.

TABLE IX.

Output of Coal at Smaller Coalfields 1931.

District	Total Quantity of Saleable Coal Raised 1931 in millions of tons.
Leicestershire	2.6
Kent	1.6
Cumberland & Westmoreland	1.5
Forest of Dean	1.1
Somerset & Bristol	1.0
Shropshire	.6

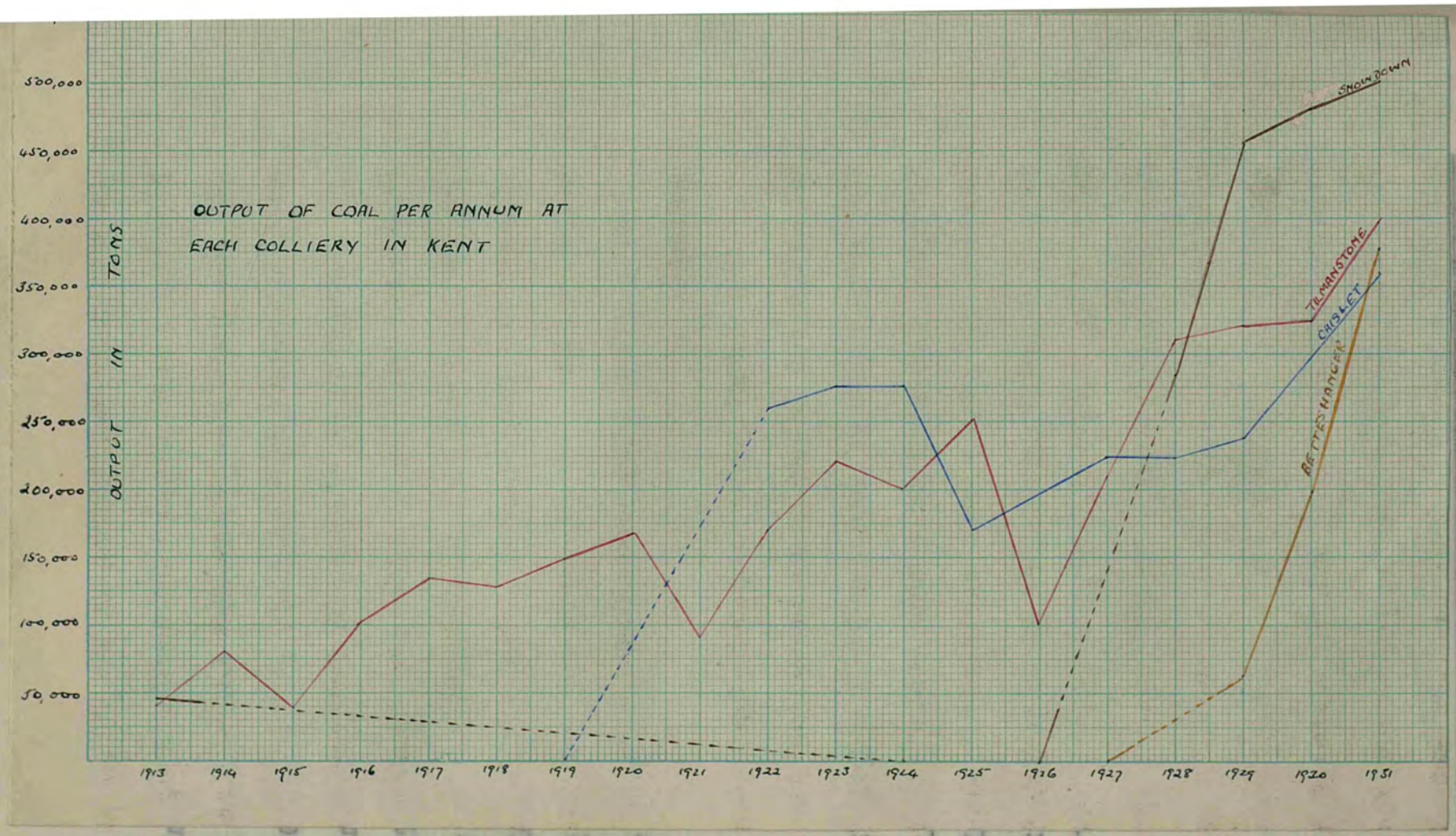


Fig.19.

Note (1) Dotted lines represent approximations where exact figures have not been obtainable. Figures for Tilmanstone from information supplied by the colliery and for Chislet, Snowdown and Betteshanger from the yearly returns in the "Colliery Year Book" and from annual reports of the companies.

(2) In 1924 Snowdown was closed for reorganisation and reopened in 1926.

All the collieries on the field are large and well-planned. They are worked entirely by electric power and steam and the coalfield shows the highest output and the biggest utilisation of electricity, per colliery, in England and Wales.

Snowdown is planned to produce a maximum of 600,000, and Betteshanger, 750,000 tons per annum. The electric power for the two is generated at Betteshanger, while Chislet and Tilmanstone both generate their own. Coal-cutting machinery is not in use, but electric and compressed air conveyors are in use, and a high percentage, 31·4 in 1931, of the coal is cleaned.

The large scale and efficient working of the collieries is indicated in order to emphasise the future probability of the production of comparatively large amounts of coal at economic prices within this area. At present costs of production are high. The residential nature of the locality causes costs of living to be somewhat high and as a result the Kent miner receives a high wage. A comparison of the graphs, Figs 21 and 22 shows the high costs of production in Kent compared with those of Great Britain generally. In 1926 total costs in Kent averaged 3/- per ton more than for the whole country and of this $\frac{2}{3}$ was represented by the higher wages in the area. No figures are available since 1926 and the total costs of production have dropped considerably with the increase of output throughout the field and may be expected to

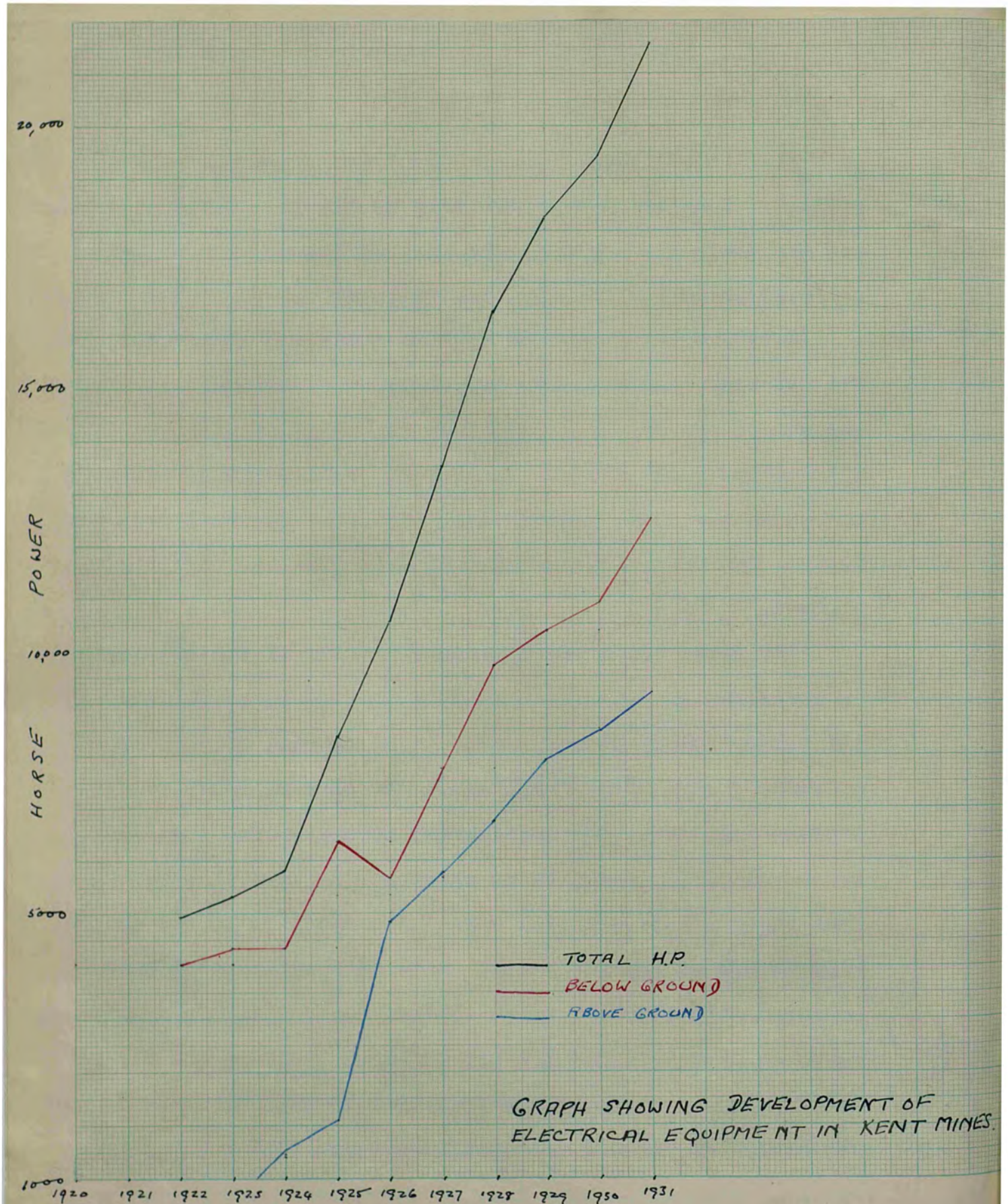
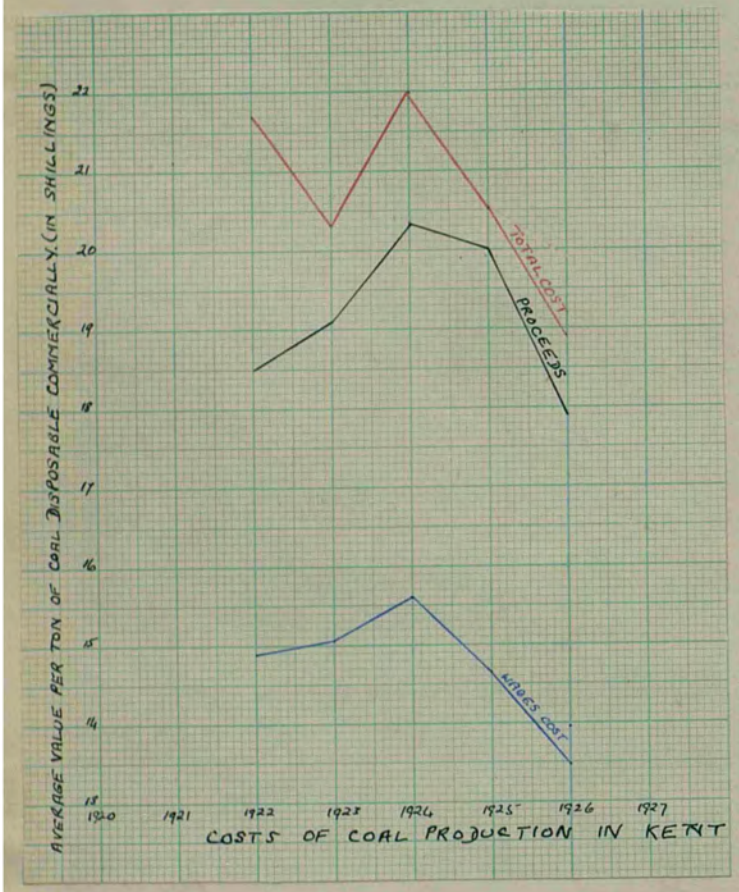

20,000
15,000
10,000
5000
1000
HORSE POWER
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
TOTAL H.P.
BELOW GROUND
ABOVE GROUND
GRAPH SHOWING DEVELOPMENT OF ELECTRICAL EQUIPMENT IN KENT MINES.

Fig.20.



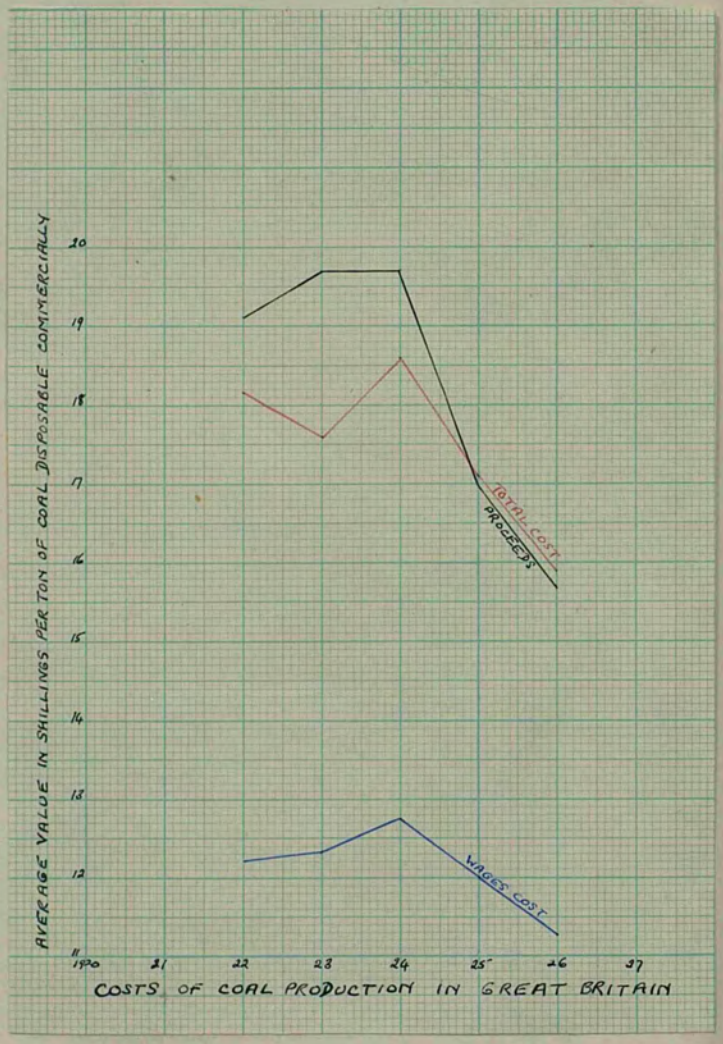


Fig.21.

Fig.22.

Note. Figures from Annual Reports of the Secretary for Mines.
No figures available for Kent after 1926.

Fig.23.

From Annual Reports of Secretary for Mines.
Note: 1918-1921 show abnormal post-war prices
and 1926 abnormal prices during coal strike.

Fig.24.

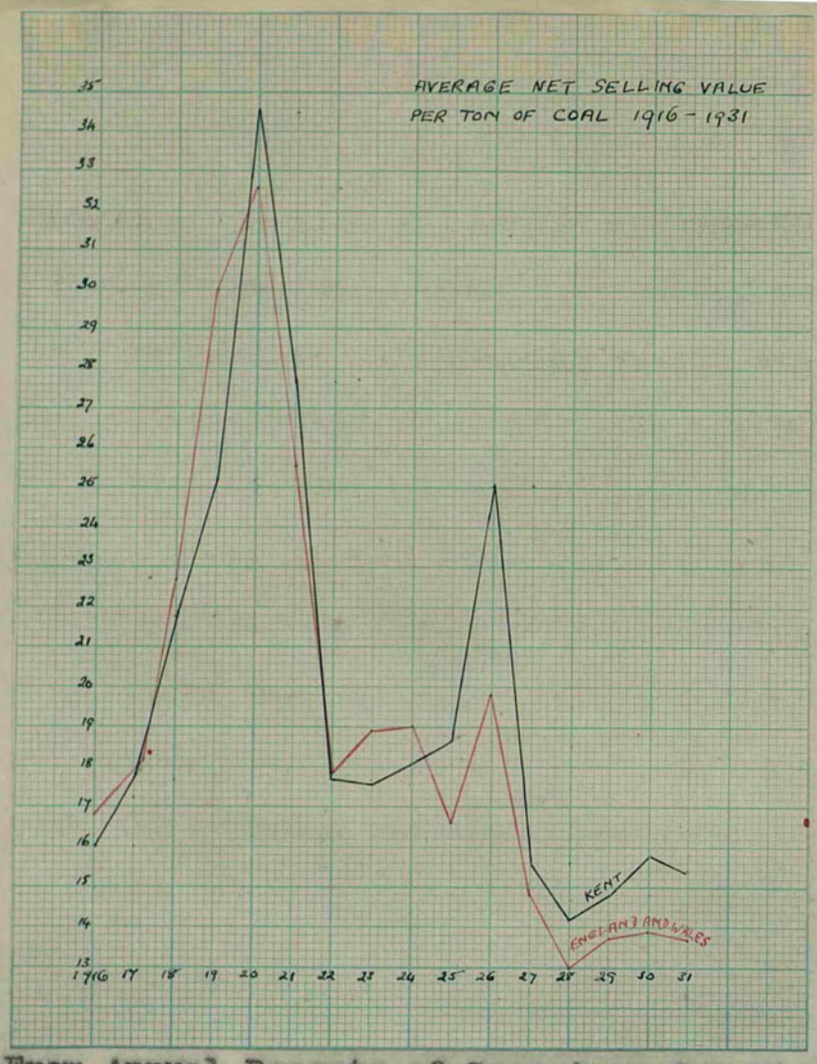


Fig.23.

From Annual Reports of Secretary for Mines.
Note: 1918-1921 show abnormal post-war prices and 1926 abnormal prices during coal strike.

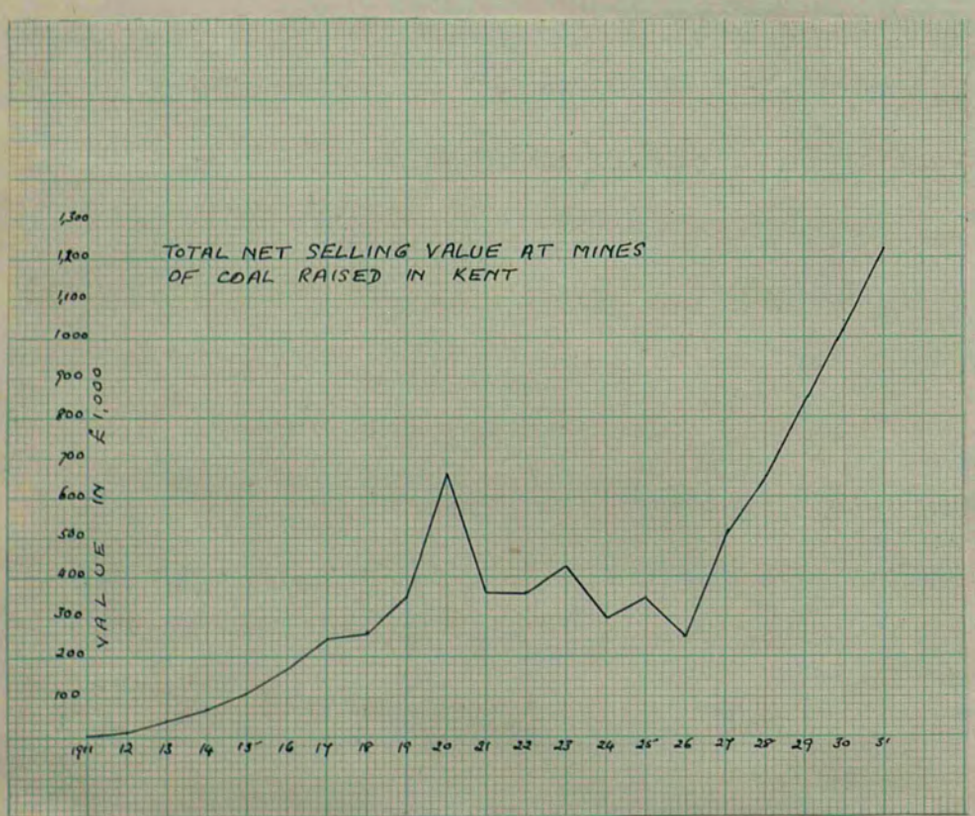


Fig.24.

drop further when the mines are working to capacity. The Quota System necessarily hampers the development of a new field and the future increases in production will be less rapid than might otherwise have been expected. The allocation made to the district in 1931 under Part I of the Coal Mines Act (1930) was 1,671,600 tons and an amount slightly in excess of this was raised, which points to readily available markets.

High production costs are to some extent offset by the good prices realised for the coal, (see graph, fig.23) which reflect both its quality and suitability for its markets.

Labour.

The total number of persons employed in the coal industry in Kent and the numbers at individual collieries are shown in Figs 25 and 26.

The most marked effects of the discovery of coal in Kent, on the area itself, is the presence of an alien mining population. Other than mining, there has been no industrial development of the region; no change in agricultural or other pursuits which may be directly attributed to the development of the coalfield; a certain re-arrangement and expansion of transport facilities within the region, the effects of which have not been generally felt by the mass of inhabitants, who have nevertheless derived a certain advantage from the presence of cheap fuel and the provision of electric current. But despite all this the character of the region has been surely

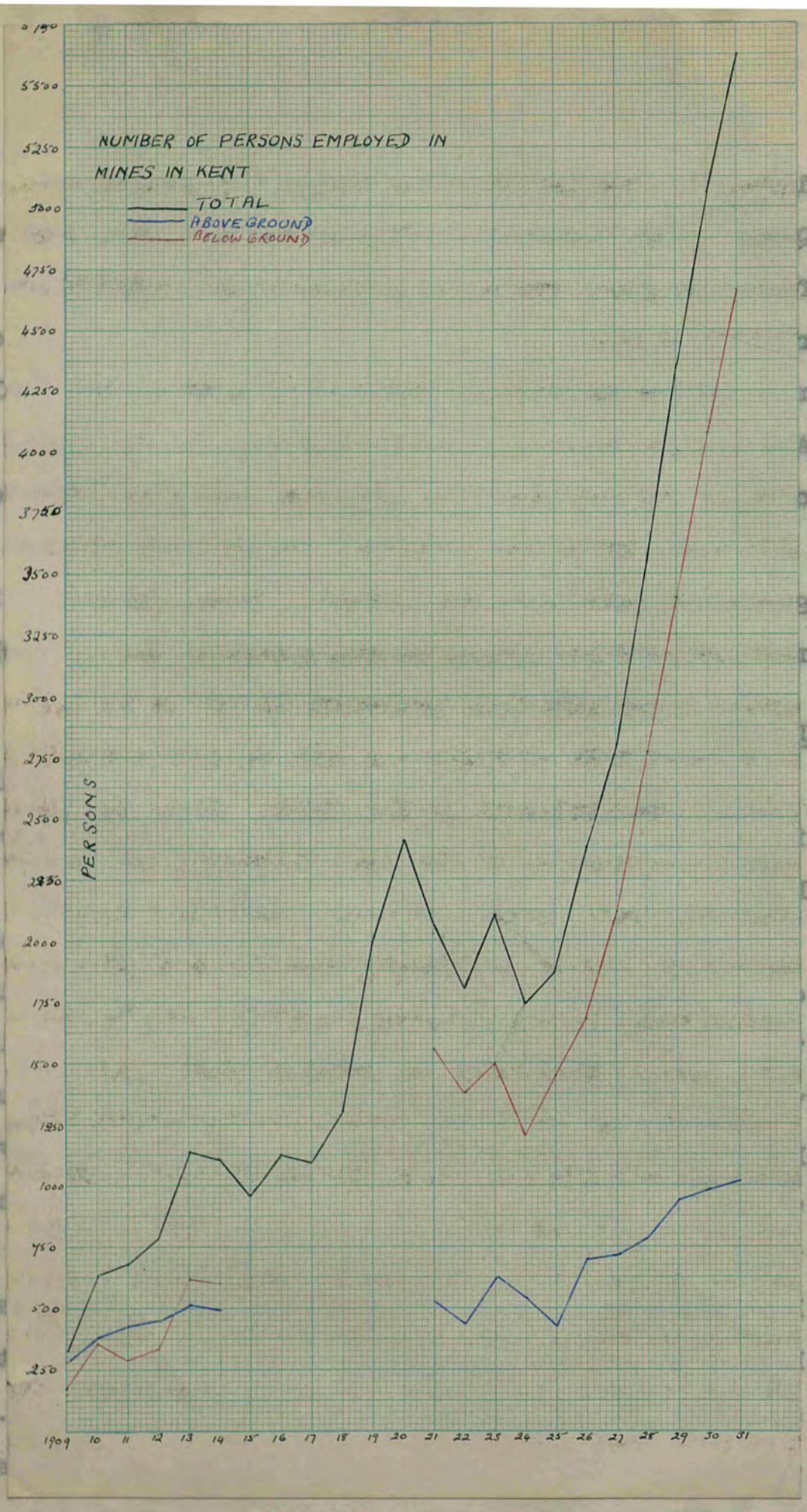


Fig.25. From Annual Reports of Secretary for Mines.

changed by the introduction within a period of some 20 to 30 years of 5½ thousand actual mine workers, who, together with their families make a new population of probably not less than 20,000 persons.

In the early days, there was a gradual infiltration of labour from other fields, good labour for the most part since most of the men came with the hope that a new area would offer them opportunity for progress. To this was added a certain amount of unskilled local labour. Local labourers, however, have never taken kindly to employment at the collieries and almost invariably have preferred to return to agricultural work at a lower rate of wages - a fact which has considerably puzzled the newcomers to the field. Since the spread of the general depression in the coal industry, the incorporation of even this small amount of local labour has ceased (with the exception of some boy-labour) and the mass of mine-workers coming with the rapid expansion of the collieries since 1927, have been drafted from the surplus mining population in other fields of Great Britain. There are representatives of almost all the fields, Scots, Welsh, Midland and North Country and from this the heterogeneous nature of the new population may be deduced. It is, however, unified by a common pursuit, common recreations, often a common political outlook and so forth, but between it and the native population there are but few points of contact and little sympathy. After thirty years

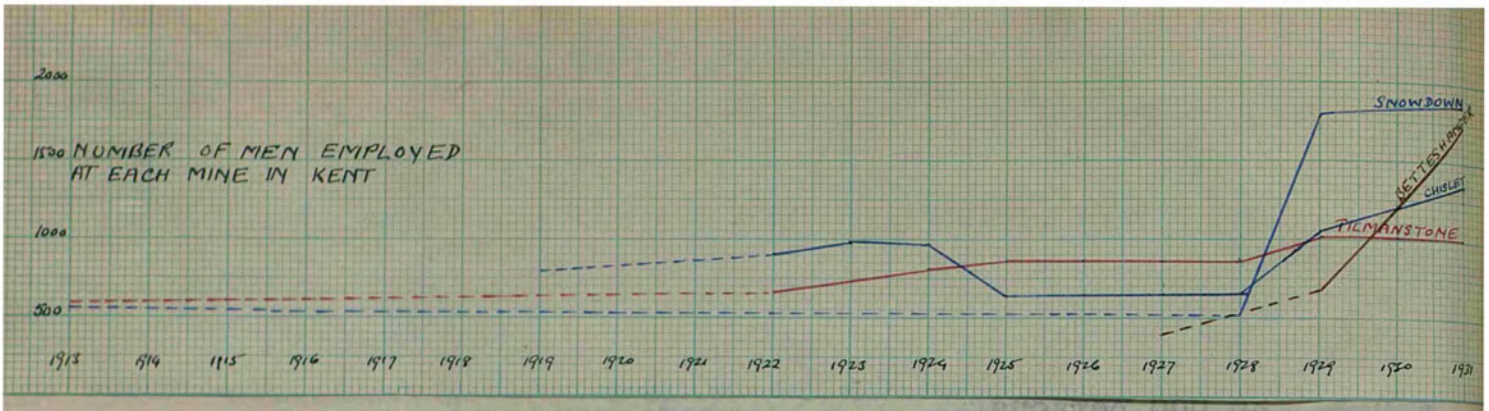


Fig.26. From annual returns in "Colliery Year Book". Dotted lines show approximations in absence of precise information.

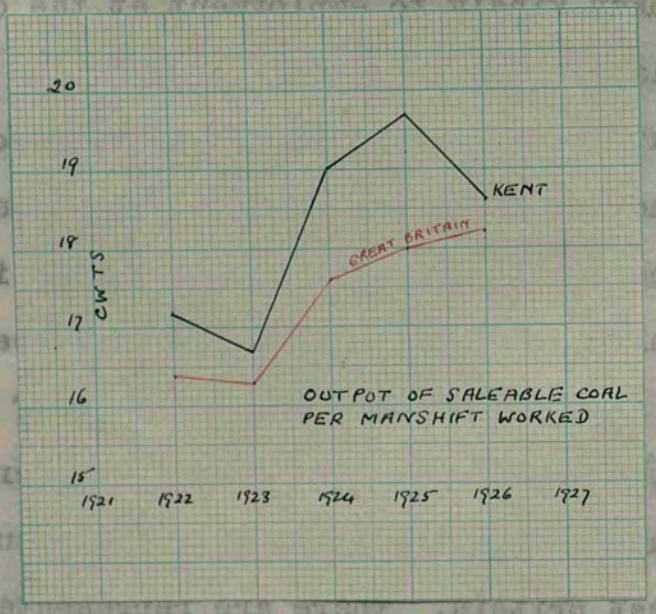


Fig.27. No figures available for Kent after 1926.
Note (1) Figure for this period applies to Chislet and Tilmanstone (Snowdown closed 1923 and Betteshanger not sunk). High output per manshift for Kent compared with England and Wales, denotes good underground conditions. (labour supply similar to that of rest of Great Britain).

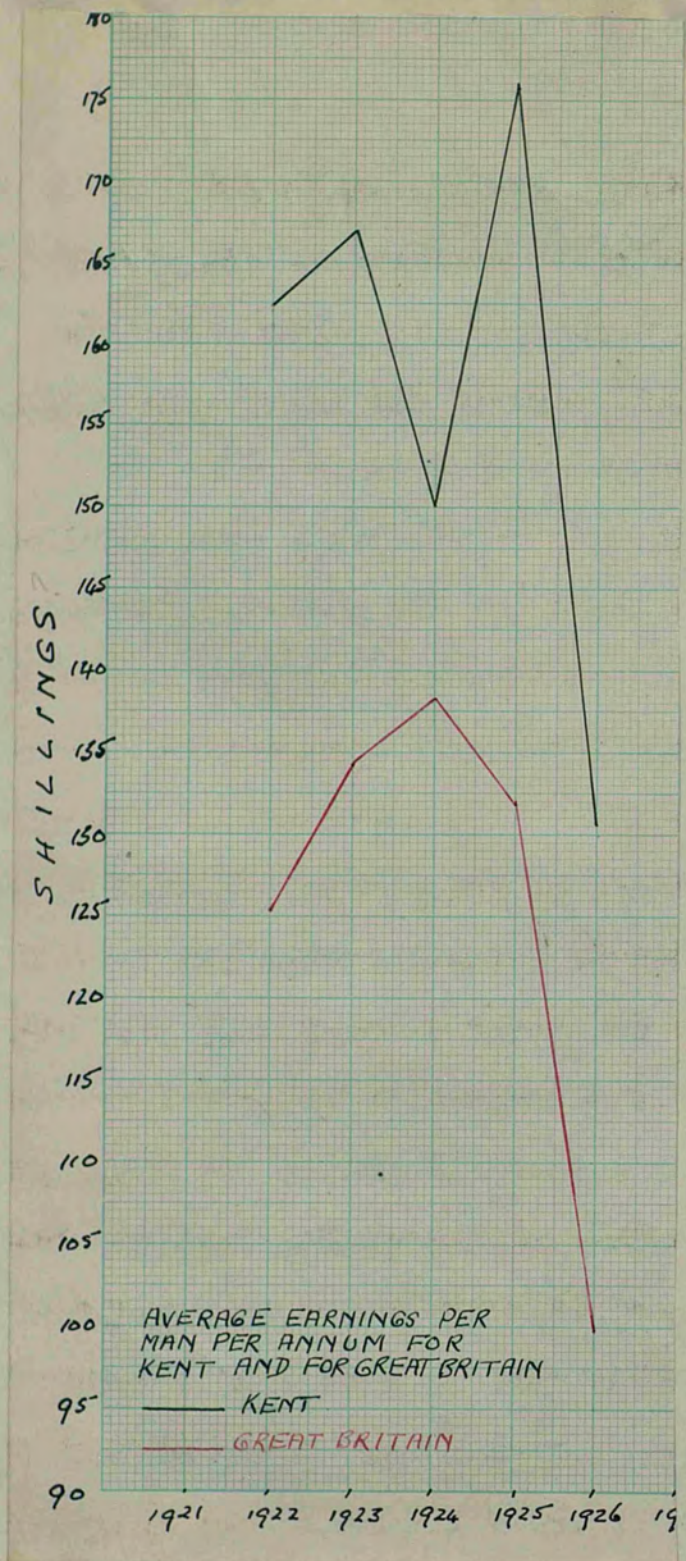


Fig.28.

No figures available for Kent after 1926. There are no district agreements for percentages payable in excess of the Basis Wage Rates in Kent, each colliery making individual arrangements.

the miners remain grafted on, and though in time there must be a certain amount of absorption, the process is likely to be extremely slow and probably never complete. The Kentish agriculturalist regards the miner with distrust and the miner the agriculturalist with contempt[1].

A change in attitude would have resulted from the growth of other industries in the region. Industries which would have employed local labour and thus gradually produced an industrial viewpoint more sympathetic to the miner.

This question of the absence of other industries is having a serious effect on the younger element of the new population. The opening-up of the collieries has up till now provided employment for the young growing male population but a point has been reached when, expansion being now checked, the mines themselves cannot completely absorb the young generation. In the case of the girls of the mining families the position has always been bad. There is practically no employment for them whatever. A very limited number of them find domestic employment in the neighbourhood, but even were there sufficient of this available, they are not on the whole suited to this type of work - they are potential factory workers. Some attempt is made by the social workers in the mining villages to encourage home industries and crafts as a partial solution of the problem.

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(1) Much of the material in this section is a result of discussions with Mr John Archibald (who assisted in preparing the Regional Planning Scheme and has been closely associated with housing and other social developments) and certain of the older miners who have worked in the field since its beginnings.

The much less rapid development of the field than was anticipated at the outset is reflected in the settlement of the new population.

It was recognised that the old type of mining village was not a good social unit and it was planned that settlement should be grouped in a few urban centres, rather than many scattered villages, centres so placed that each would serve more than one pit with its surrounding industrial area, and which by reason of their size would offer opportunities for the development of public services and social amenities impossible in small settlements. (See Maps, Figs 29 and 30).

This ambition has had only a very limited realisation. The early mining population was drawn into the large urban centres which fringe the field, notably into Dover. With the post-war expansion definite housing schemes were undertaken and in the case of Aylesham, which houses the Snowdown miners, the plan and lay-out of an urban centre was adopted, but it has not been fully built and the existing settlement is little more than a village. Elvington which serves Tilmanstone and Hersden which serves Chislet are small settlements planned on village rather than on urban lines and the miners at Betteshanger - the latest developed pit - are settled in an area adjoining the town of Deal, the Aylesham experiment having made Messrs Pearson & Dorman Long Ltd. unwilling to attempt a similar

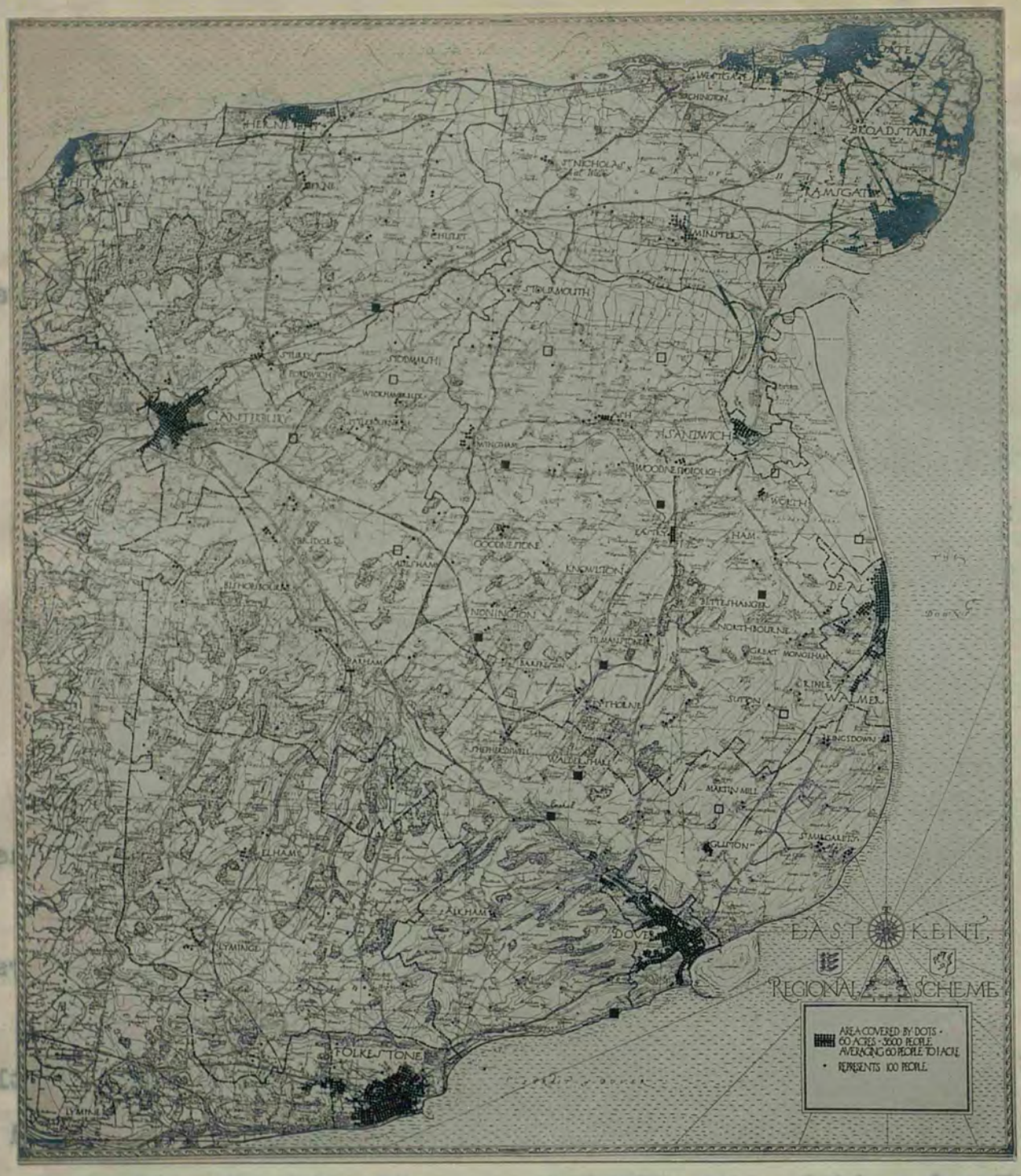


Fig.29. Map showing settlement of existing population in 1925.
Note (1) General absence of large settlements from the coalfield.
(2) Marginal location of urban settlement.
From East Kent Regional Survey. 1925.

housing scheme for their second pit. They preferred to settle the miners where there were existing schools and churches and other public buildings and social amenities.

To examine the settlement of the population in more detail. The large urban centres lie around the coalfield, not within it. Chislet colliery has easy connection by both road and rail with Canterbury and Ramsgate, and Snowdown by rail with Dover. Since the construction of the East Kent Light Railway, Tilmanstone has rail connection with Dover and a somewhat indirect road connection with that town. Betteshanger lies near the main road from Sandwich to Deal.

These towns attract a considerable percentage of the miners who usually travel to and fro by road in buses which they run themselves. At Chislet about $^{1}/_{3}$ of the mine-workers live in Ramsgate and Canterbury and at Tilmanstone and Snowdown a rather higher percentage live in Dover. The attraction of these towns is offset by comparatively high costs of living, especially at Canterbury and Ramsgate which are mainly residential towns; by the scarcity of suitable accommodation and the inconvenience of travelling four or five miles to the pit. This travelling is made easier by the existence of pit-head baths. At Chislet there is bathing accommodation for 315 men and at Tilmanstone for 1,008 men. Baths are planned for Betteshanger and Snowdown, and that at Betteshanger is in course of erection, its completion being hindered by drainage

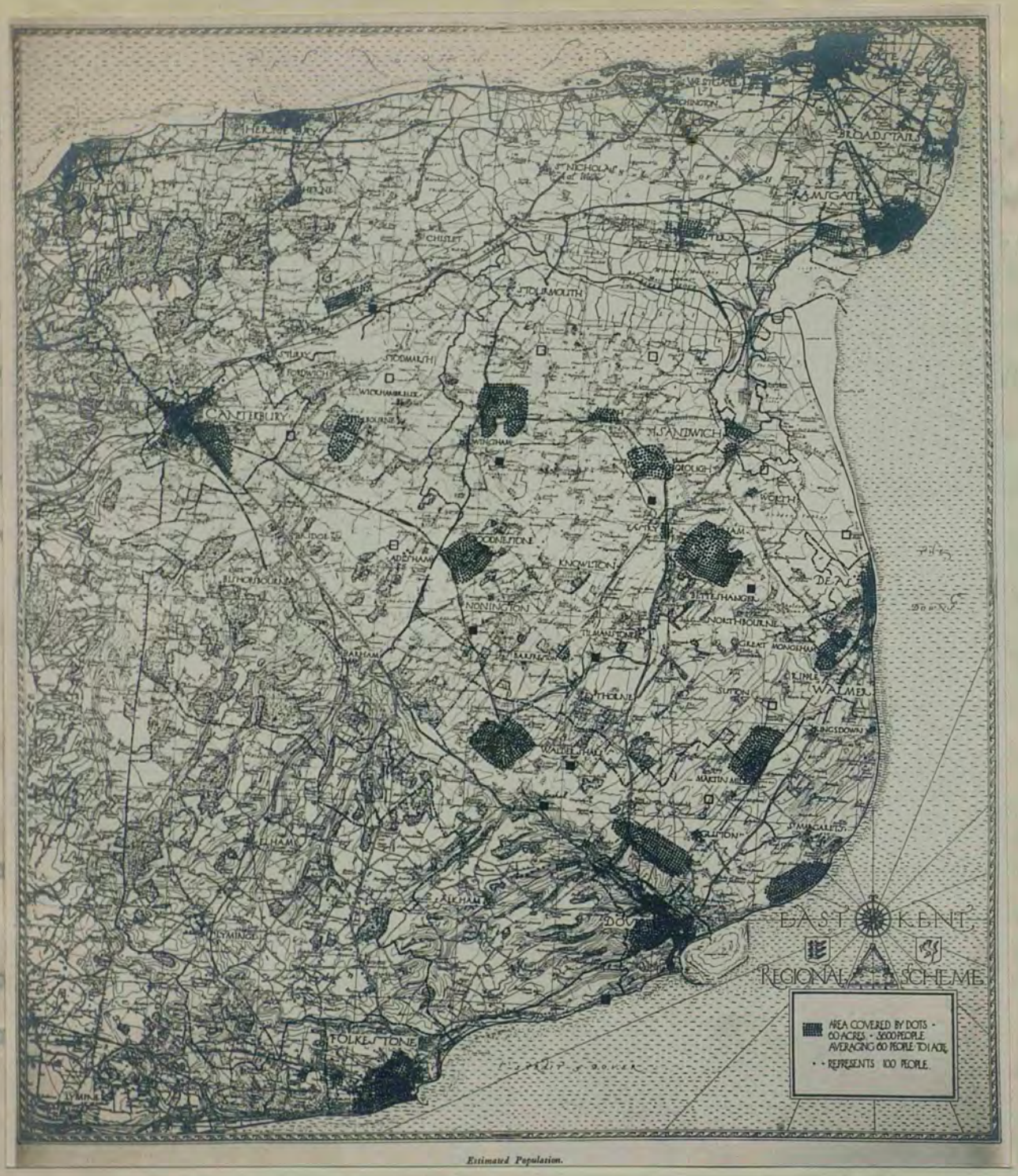
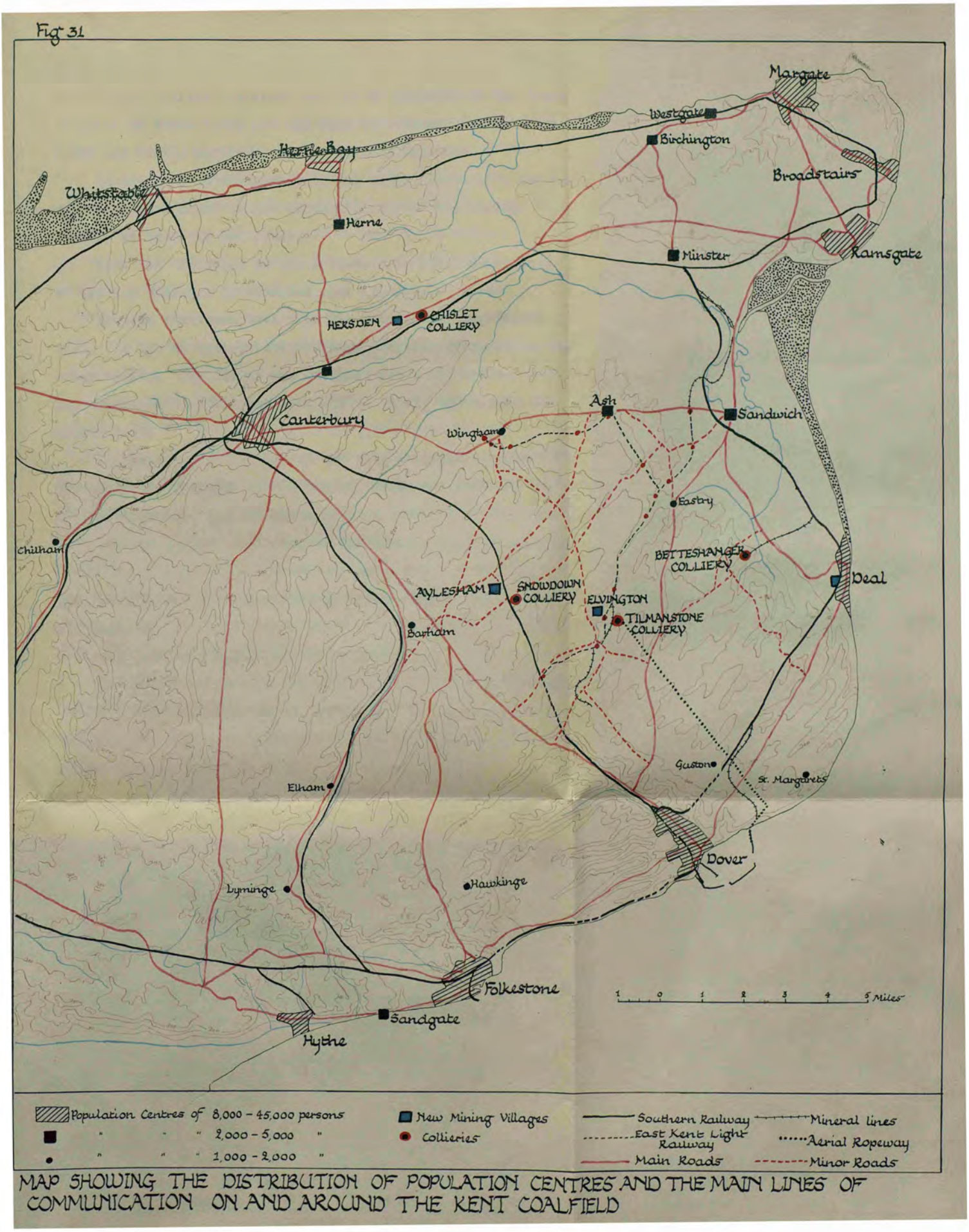


Fig.30. Map showing proposed settlement of expected new population.
Note (1) Concentration in urban centres evenly distributed and so placed as to serve 2 or more pits (pits marked as black squares).

From East Kent Regional Survey 1925.

Fig 31



MAP SHOWING THE DISTRIBUTION OF POPULATION CENTRES AND THE MAIN LINES OF COMMUNICATION ON AND AROUND THE KENT COALFIELD

difficulties already referred to. It is designed in the first instance to bathe 2,016 men and will be extended to deal with 2,520 men as the colliery reaches maximum capacity.

In addition to settlement in the towns, there is a certain amount of settlement in the large villages of the region, notably at Eythorne and Sturry.

With the exception of the Betteshanger settlement, each of the new villages is situated near its pit.

Hersden stretches back from the main Canterbury-Thanet road. It has an open relatively high position overlooking the Stour valley. The layout was designed for 1,000 houses, but not nearly this number has been built. About 900 miners are housed here.

Elvington is not placed on the site originally suggested for it in the planning of the region, which was near the village of Shepherdswell, but has grown round a group of houses built near the pit in the early days of the field. It lies some two miles from the main Dover-Sandwich road, on the brow of a hill and the site has the advantages of a high, open, well-drained position, and nearness to the pit but it is rather far from the main communication lines of the region.

The Betteshanger Colliery settlement occupies the gently rising ground where the Chalk begins to emerge from beneath brick-earths to the SW. of Deal. It is virtually an extension of the town in this direction.

The most ambitious housing venture, Aylesham, lies to the NW. of Snowdown pit and is intended to serve both that pit and a possible future pit in the neighbourhood of Adisham. 600 acres on either side of the Canterbury-Dover Railway have been bought but building is to be restricted to the area SW. of the line. "The site is a superb one - a simple bare fold in the chalk gradually rising from the railway and closed at the top by a mighty beech-wood; the length of the axis is $^{7}/_{8}$ mile and the rise just 100 ft. The plan has endeavoured to make use of the site for its very simple motif: a main broad avenue along the bottom of the fold starting from the railway, with a shopping square half way up where the roads from the pits N. and S. cross the main axis; further up the avenue is stopped by the site of a church which will be outlined against the drop scene of the beech-wood. Near the railway end, where the undulations are steepest, the roads follow the contours and converge on the market square: above it, and round the church, the leveller ground permits a more geometric layout. Other sites for churches and schools have been reserved at focal points. The only other feature of note is a sort of encircling boulevard whose shape has been largely determined by some existing trees on the N. side..... The three sides of this site possess barriers; the railway at the base; on the S. side a narrow belt of woodland, locally known as a "shave", and on the N. a bank and woods. Along this latter side passes

a road which will eventually become one of the new main routes (Thanet-Folkestone): it is intended to refrain from building along it. The apex of the triangle is filled with the old beech-wood, and on either hand, advancing somewhat down on either side, are newer larch plantations. The town is thus enclosed and sheltered from the fierce winds that beat about this jut of England; it will not be permitted to stray beyond its green walls."[1]

These aspirations are, as yet, only very partially realised. The lay-out, as devised in the plan, is there, but the site was planned for 2,000 houses, with a possible extension to hold a further thousand. Of that number only about 500 have been built. There is a school, churches and a public house; the shops are few and mostly cooperative since private enterprise has found the miner a difficult customer. The whole village has a depressing air of arrested development. The population of 15,000 for which it was planned, is not materialising, owing to the much less rapid development of the region than was anticipated and the easy railway connection between Snowdown and Dover tends to drain the miners from this pit to Dover in spite of the poor housing accommodation for them in that town.

Throughout the new villages the houses are of an excellent type. It was hoped to give to the architecture a certain

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(1) From "East Kent Regional Planning Scheme" 1928.

Flemish note which would identify it with the locality (where successive waves of Flemish and Dutch invasions have strongly influenced domestic architecture), but this was found impossible on the score of expense. Rents tend to be high, ranging from 11/- to 17/- per week, and in certain instances the colliery companies help by subsidies though this North Country practice is not common throughout the field.

Markets and Transport.

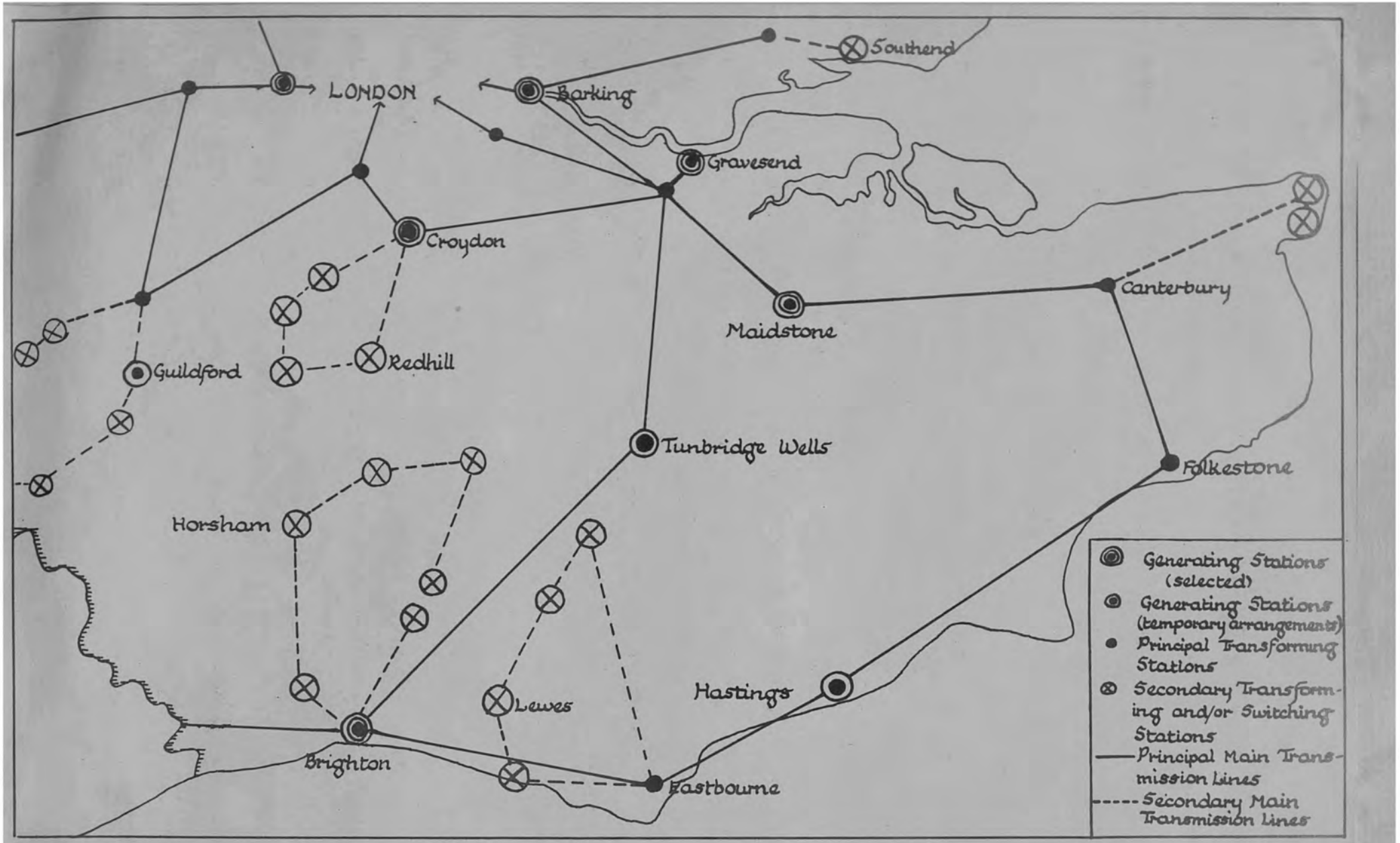
During the period of colliery establishment it was confidently expected that the coalfield would become the centre of great industrial activity; that evolution here would follow a similar course to that followed in the older fields and result in the establishment of heavy industries (in view of the iron-ore deposits) and various ancillary industries. The fact of the diminishing importance of coal deposits in the localisation of industry was overlooked. The importance of coal itself as a source of power is diminishing and the present conditions of cheap transport together with the possibility of long-distance power transmission are causing the location of industry to be controlled rather by considerations of nearness to markets, or to raw materials, suitable labour supplies cheap sites etc., than by the proximity of power sources.

The development of the Kent field, therefore, seems likely to have more far-reaching effects on already established industrial areas than on the development of a new centre of industry, and as a result its main markets lie outside the region.

Existing markets may be considered under three headings, local, home and export.

Consumption at the collieries takes three forms:

(1) As a source of power for the colliery workings and domestic fuel for the miners.



SKETCH MAP SHOWING THE ELECTRICITY SCHEME (1927) FOR S.E. ENGLAND

Fig.32.

(2) As raw material for the manufacture of patent fuel at Tilmanstone colliery.

(3) For the generation at Betteshanger colliery of supplies of electric power above those needed for colliery working and which are used to supply Deal and its neighbourhood with electricity.

The first of these needs no elaboration. With regard to the second, in order to overcome the disability for household and other purposes of the coal of the Beresford seam owing to its friability, plant has been installed at Tilmanstone colliery for the manufacture of small briquettes, "Coaloids", for domestic consumption and larger briquettes for manufacturing purposes. The fuel has proved successful; it burns well, is clean to handle and economical to store, and a growing market is being found for it in Kent and Sussex and SE. London. As a result the plant is being further extended.

With regard to the supply of electric current, the distribution is purely local. A wider utilisation of the field for the generation of power was hoped for, and the generation on the field of the power supply for London was even envisaged. The map (Fig.32) showing part of the Electricity Scheme (1927) for SE. England, as adopted by the Central Electricity Board, shows the nearest chosen generating station to lie at Maidstone, 30 miles W. of the field. In their choice, the Board were influenced, not by the presence of fuel supplies, but by the

existence at this point of a suitable generating station capable of enlargement and, more especially, by its situation in an area of big demands. It provides an external market for the coal and 80% of the coal used at the station is slack from Chislet.

A future use for coal at the collieries will be provided by Low Temperature Carbonisation Plants, one of which has already been erected at Snowdown and more are projected.

Other local markets exist:

(1) for household coal, and are supplied from Betteshanger and Tilmanstone ("Coaloids").

(2) for various grades of coal to gas works and other public utility undertakings.

(3) for large coal to the Southern Railway and the East Kent Light Railway, which serve the field. In 1932 the Southern Railway alone took 400,000 tons.

The main home market to-day is the industrial area of NE. Kent. The cement industry of the Thames-side and Medway valley is the most important customer, and for this the coal is peculiarly suitable since the rotary kilns of modern cement works are fired by pulverised fuel, and the slack coal from the Kent field is chemically suitable and economical to use since it needs little further preparation before being fed to the kilns. A very large proportion of the slack coal raised

at Tilmanstone is used in this way and the cement firms take the bulk of the Chislet production.

Its use in the Paper Industry of the county is controlled by the location of the mills and by the type of boiler installed in them. If the mills are situated where they must use rail-borne coal, they almost invariably use Kent coal, since it offers advantages of cheapness of transport and of quickness of delivery obviating long storage and deterioration at the mill. The mills of the Maidstone paper manufacturing region, with minor exceptions, take the coal, certain mills having installed special furnaces to take Kent slack and others using large coal from Snowdown and Betteshanger. Its steam-raising properties are found to be good, but it is somewhat smoky.

On the Thames-side it comes into competition with cheap sea-borne coal from E. coast ports, and where it is not especially wanted for use in pulverised fuel furnaces, and even sometimes despite its suitability in this respect it tends to be displaced by North Country coals.

The fact that the London market has as yet been so little touched must also be attributed to this question of freightage and to the artificial conditions in the coal industry at the present time. Kent coal is very largely rail-borne and there has been no drop in rail freights comparable to that in shipping freights, and this makes competition in the London market difficult since it nullifies Kent's advantage of location.

Industrialisation in Outer London is most pronounced in the N. and W. sectors, i.e., in those areas where Kent's advantage of nearness is least effective. The potentiality of the area as a market, however, remains.

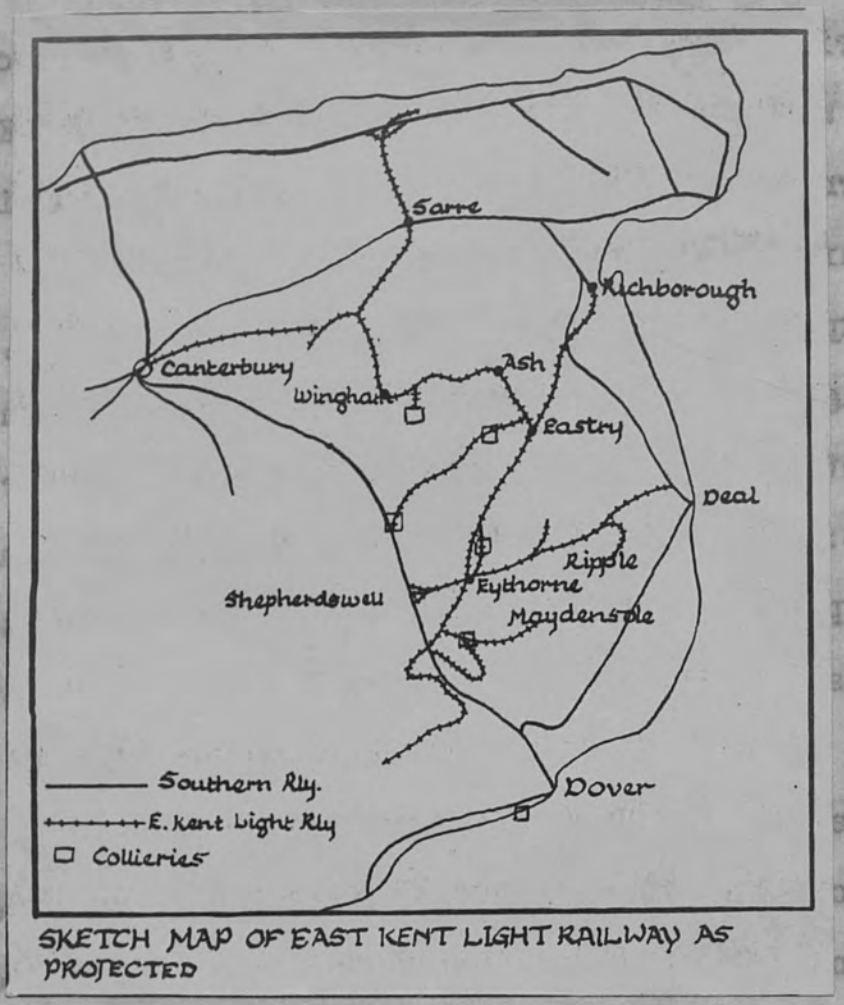
Export trade is small and new but growing, stimulated by advantages of situation with regard to continental centres of consumption; by the suitability of the coal for certain foreign markets: and by the glutted condition of home markets.

Export is from Tilmanstone, Snowdown and Betteshanger, and goes to France, Belgium and Holland, with occasional cargoes farther afield to Spain and Morocco.

The coal is used in steel works in Holland because it is found to have a good coking heat and to blend well with German coal, and to this end some 5,000 tons a month were shipped to Sluiskil alone in 1932. Cement manufacturing regions in France and Belgium constitute the other major points of consumption - for reasons similar to those causing the strength of the English cement region market.

In 1930 total export to the Continent was 21,000 tons, in 1931, 77,000 tons. No figure is available for 1932, but the figure is likely to show a considerable increase.

The dependence of the field on outside markets places the maximum emphasis on transport conditions and points of exit.



SKETCH MAP OF EAST KENT LIGHT RAILWAY AS PROJECTED

Fig.33.

Apart from that delivered for local consumption, which goes by lorry, all the coal, even whether ultimately exported or borne coast-wise, has to be taken overland for a certain distance. This land haulage is provided in two ways, by railway, and by aerial rope-way. Snowdown and Chislet adjoin the main lines of the Southern Railway; Betteshanger is connected to the main line by a mineral line and Tilmanstone by a branch of the East Kent Light Railway. This railway, though projected principally in the interests of the collieries, was not intended for mineral transport only but to give general rail connection between the Canterbury-Dover line and the Canterbury-Thanet line. It hoped to carry passengers and agricultural trade, notably that of the Wingham-Ash area, but owing to the superiority of road transport for this latter type of trade, it has not achieved its purpose. The railway makes use of the valley of a tributary of the Little Stour and then, from Eastry, utilises folds in the chalk dip-slope, a short tunnel being necessary beneath Golgotha Hill before it joins the main line at Shepherdswell. It has not been completely built as projected (see map, Fig.33) and is only effectively used from Tilmanstone colliery to Shepherdswell. Occasionally trains are run N. to Wingham to keep the line open, but little produce is carried.

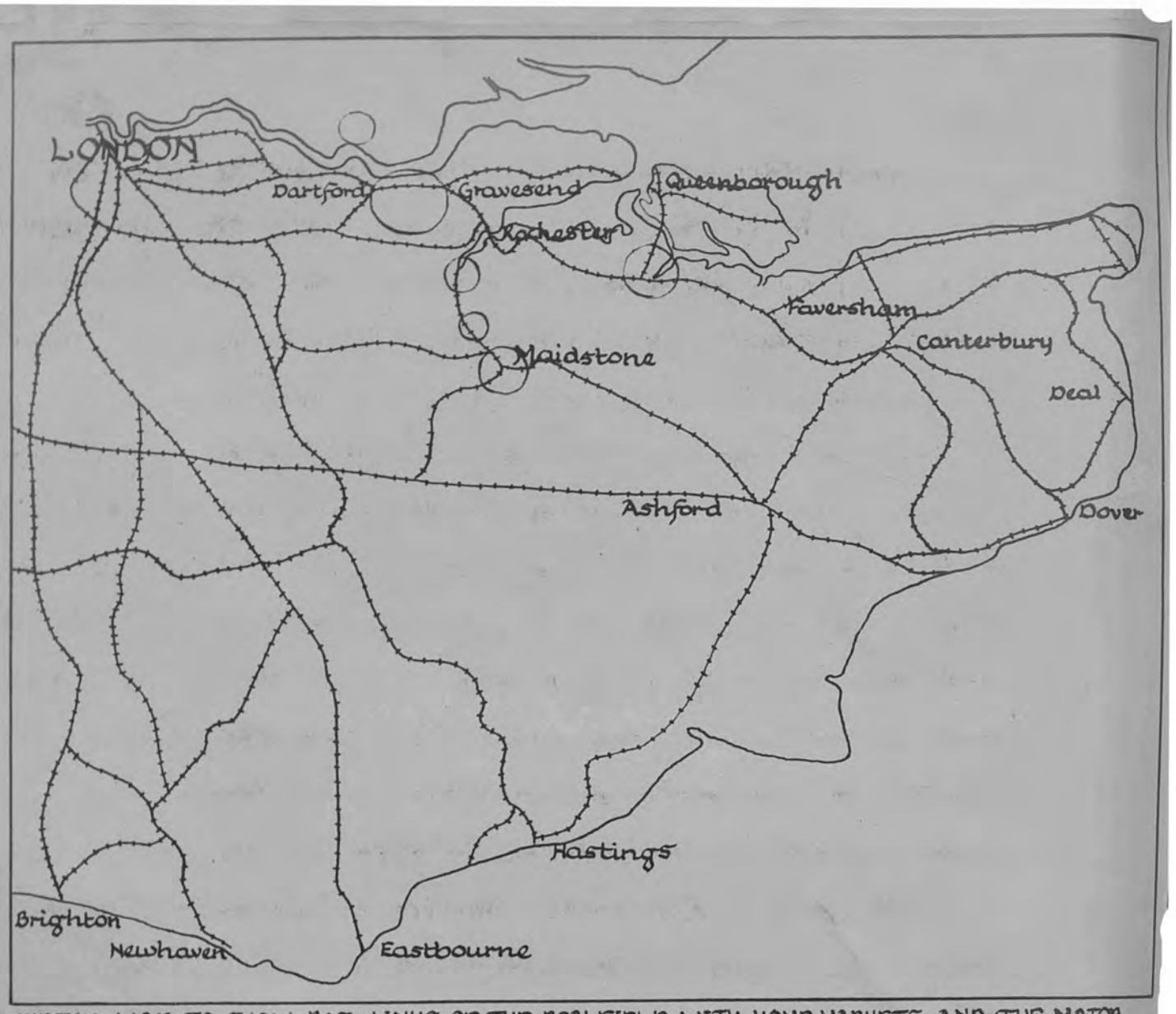
The amount of coal carried by the Southern Railway from the collieries during the period 1928-1931 is given in the

following table:

	Betteshanger tons	Snowdown tons	Chislet tons	Tilmanstone tons
1928	5,950	322,635	245,108	254,744
1929	33,223	441,412	256,379	257,886
1930	127,389	442,703	267,715	209,119
1931	293,387	489,877	344,135	172,813

A comparison with the figures of total production at the collieries (Table 4 of Appendix) shows that these figures form the bulk of Snowdown and Chislet production. The 1931 Betteshanger figure leaves a margin of 82,000 tons which represents coal used for generating power at the colliery and coal distributed for local household consumption, and the Tilmanstone figure is the balance of coal not used in 'coaloid' manufacture and not carried by ropeway. The latter was put into commission in 1930 and accounts for the low figure for rail-borne coal of 1931.

The bulk of the coal goes straight to its point of consumption. Rail connection is good to all parts of SE. England and London and the Railway Company provides the wagons, a system which allows each wagon to make a maximum number of journeys per month, and which has helped the establishment of the collieries by a saving in capital cost.

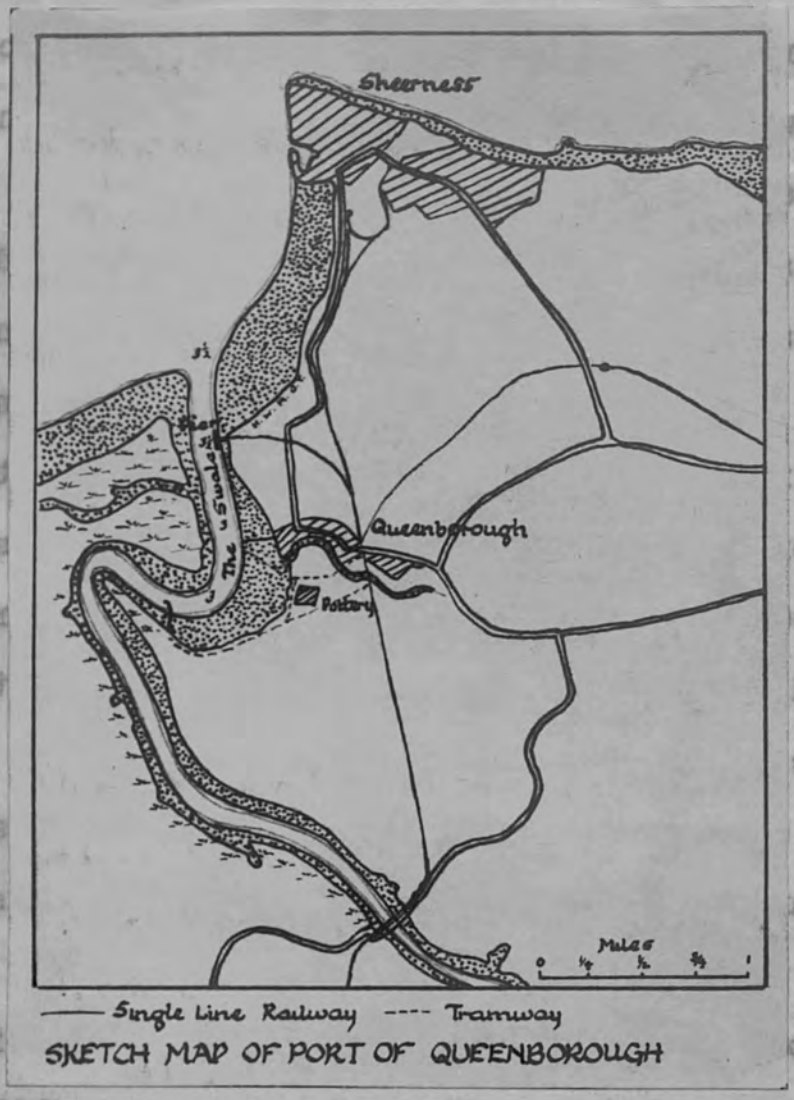


SKETCH MAP TO SHOW RAIL LINKS OF THE COALFIELD WITH HOME MARKETS AND THE MAJOR POINTS OF INDUSTRIAL CONSUMPTION

Fig.34. Note (1) Position of Queenborough. Well placed for Thames traffic, badly placed for continental traffic.
(2) Advantages of Dover in this respect.

The residue of the coal is taken to the ports either for coastwise shipment or for export. Until the export trade began to assume commercial dimensions, most of the water-borne coal was shipped from Queenborough, which is admirably placed for Thames traffic but where facilities for handling coal are limited. The coaling plant is not extensive and though there is ample room for sidings and shore-developments, there is no deep water here and it is difficult to load vessels of more than 2,500 tons. The port is badly placed in relation to the coalfield for Continental export. In 1931 of the total shipment here of 173,323 tons, only 3,700 were for foreign export. The bulk of the coastwise trade goes to the Thames, but a certain amount S. to Shoreham and other S. coast ports.

The port of Richborough belongs to Messrs Pearson & Dorman Long Ltd., and has a short rail connection with Betteshanger colliery. There is every possibility here for the onshore handling of a big trade, but the estuarine conditions make it impossible. The channel is tortuous and will only take vessels up to 650 tons. These can approach only at high tide and are left on the mud at low and any enlargement of the channel would mean very costly initial dredging and subsequent continual dredging to keep the channel clear, since the silting up of this coast, which has deprived Sandwich of its seaboard and closed the Wantsum channel is still progressing.



SKETCH MAP OF PORT OF QUEENBOROUGH

Fig.35.

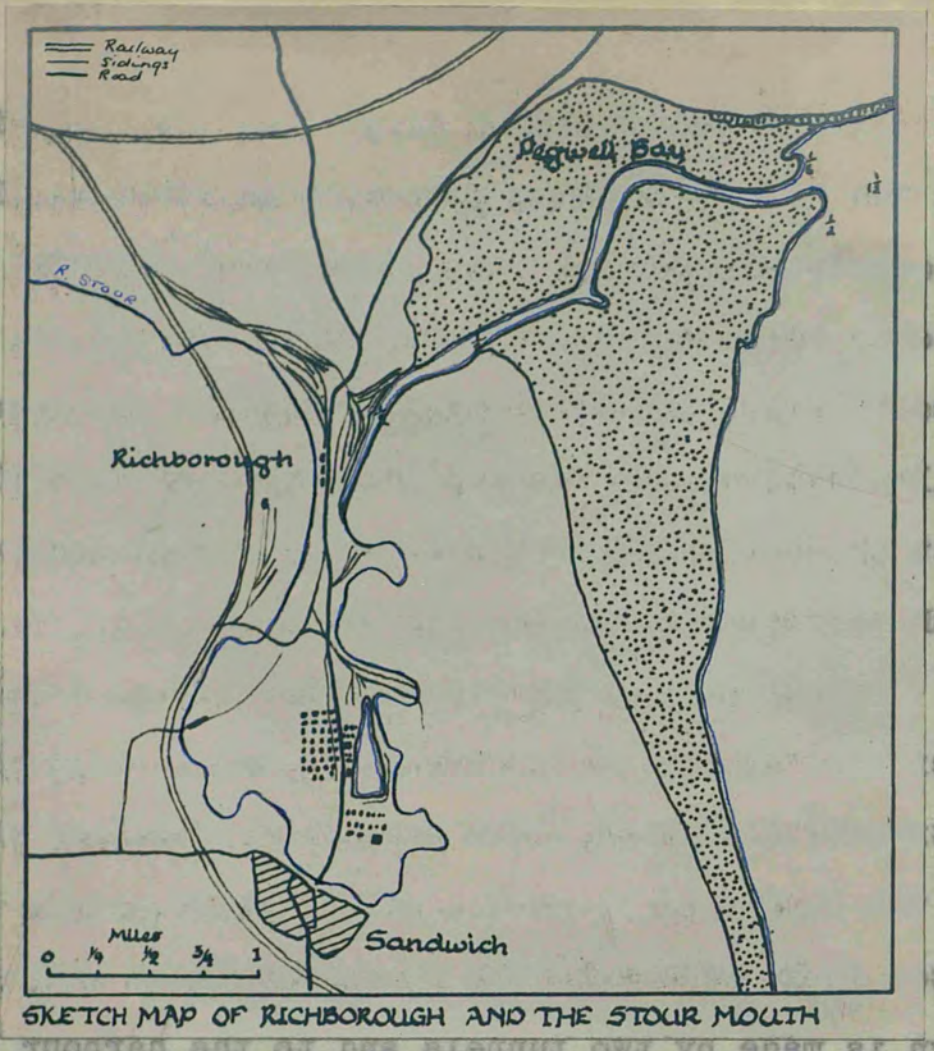
Note (1) Absence of deep water in Swale estuary.
(2) Position of pier at point where deep water approaches most nearly the land.

(Depths in Fathoms)

The natural point of export for the field is Dover. It has the best position with regard to continental markets and is connected with the three southern collieries by a rail haul of only 10-15 miles. The depth of water in the harbour is excellent at all states of the tide for the usual type of collier and though shelter conditions are not always good, at most seasons they are adequate. Difficulties here are concerned with shore, not harbour conditions.

Owing to the situation of the town in a hollow closely encircled by steeply rising chalk hills, rail entry into it is extremely difficult. The line from Deal must encircle the town on the N. border to make a sufficiently gentle gradient and after it is joined by the Canterbury line entrance into the town is made by two tunnels and to the harbour by a further tunnel. There is at no point any opportunity for extensive siding development and the rail gives connection with the western end of the harbour which is fully occupied by the older docks and tidal harbour where lie the timber - and coal - importing wharves which cater for local trade, and by the Marine Station on the Admiralty pier and the adjacent goods sheds for the handling of cross-Channel traffic.

The Eastern area, acquired from the Admiralty by the Dover Harbour Board after the War offers the most suitable, indeed the only, point for the erection of extensive coal-handling plant. This pier, which is 2,800 ft. long, has a water depth



SKETCH MAP OF RICHBOROUGH AND THE STOUR MOUTH

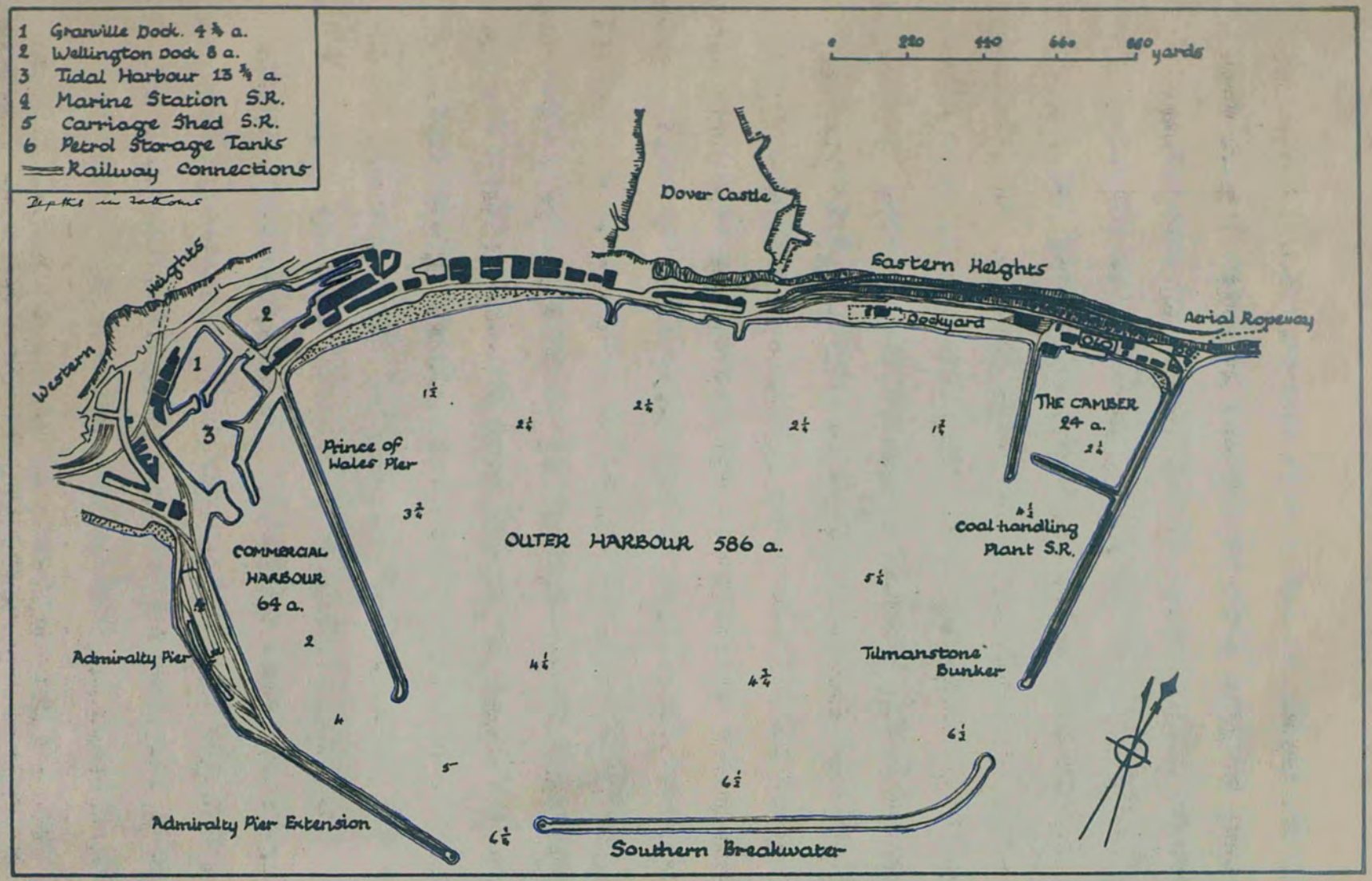
Fig.36.

Note (1) Extreme shallowness of estuary.
(2) Extensive development of rail-lines and sidings and storage buildings (black dots). A result of the use of this area during the War for the terminal point of the Government train-ferry service with France. All buildings and lines now unused.

(Depths in Fathoms)

varying from 32·36 ft. at L.W.O.S.T. and vessels of 5,000 tons can use it. It suffers from an exposed position to SW. gales and there are periods when it is difficult and sometimes impossible for vessels to berth here. However, of existing facilities, this offers much the best opportunity for export trade, but land connection with this arm is bad. Tilmanstone colliery has solved the problem by the erection of an aerial ropeway from the pit-head to a bunker at the seaward end of the arm. The line runs straight across country for 7 miles and then descends the cliffs above the harbour at Langdon Hole by two tunnels. At the colliery-end the ropeway is connected with a 1,000 ton bunker fed direct by conveyors from the colliery screens; it is carried at a rate of 120 tons per hour to the 5,000 ton bunker on the pier where it is automatically loaded into ships at a rate of up to 750 tons per hour. This ropeway has not yet been worked nearly to capacity. From February 1930 (when it was put into commission) to July 1931 some 100,000 tons were carried and shipped both coastwise and abroad.

Towards the landward end of the arm the Southern Railway has recently erected extensive electrically operated coal-handling plant, capable of loading a 5,000 ton steamer in 10 hours. It is obliged to make connection with the main rail line by bringing coal trains along the sea-front on a line laid by the Admiralty during the War under Defence of the Realm Regulations and over which the Railway has since acquired certain



PLAN OF DOVER HARBOUR

Fig.37. Note: (1) Good depth of water at Eastern Arm.
(2) Close approach of cliffs to the harbour.
(3) Position of Coal-exporting plant on E. arm with regard to:
(1) Main S.R. entry to harbour on the W.
(2) Entry of Aerial Ropeway.
(3) Sidings for coal in Dockyard.

rights from the Harbour Board. This utilisation of the sea-front for coal traffic met with strong opposition both from the townspeople and the Harbour Authority, who petitioned Parliament against it and sought to enforce the Railway Company to construct a tunnel for mineral traffic from near the junction of the Deal and Canterbury lines to the Eastern Arm. The railway contended that the cost involved would make export uneconomic under existing conditions and that the sea-front line must be used until an export of 800,000 tons was reached at which point, some alternative method, possibly even the withdrawal of the trade from Dover and the construction of docks at Deal where there is deep water and favourable shore conditions, would have to be considered. The petition failed to abolish the use of the railway but a restriction of a yearly conveyance not exceeding 300,000 tons of well-watered coal was imposed. When and should the export from Snowdown, Betteshanger and Chislet exceed this amount, local topographic conditions will impose a revisal of export methods and points[1].

Carriage along the sea-front is both difficult and slow and has been assisted by the provision of numerous sidings in the dockyard where sufficient wagons may be accumulated completely to load a vessel.

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(1) Since this chapter was written the Dover Harbour Board, seeking to extend its facilities has brought a Bill before Parliament for sanction, among other things, to build the tunnel connecting the Eastern Arm with the main line behind Dover. This Bill has not yet been passed.

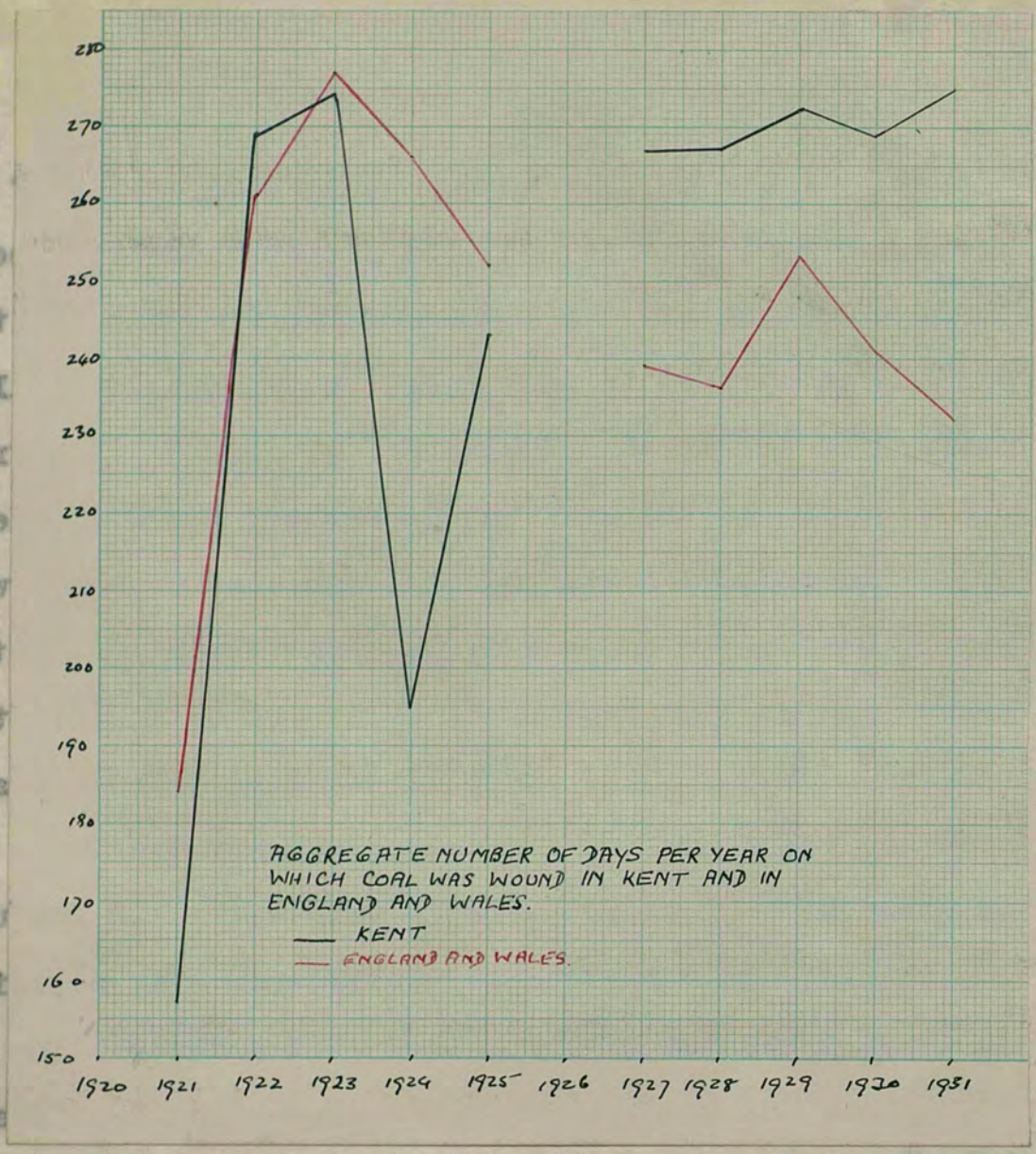

AGGREGATE NUMBER OF DAYS PER YEAR ON WHICH COAL WAS WOUND IN KENT AND IN ENGLAND AND WALES.
KENT
ENGLAND AND WALES.
280
270
260
250
240
230
220
210
200
190
180
170
160
150
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931

Fig.38.

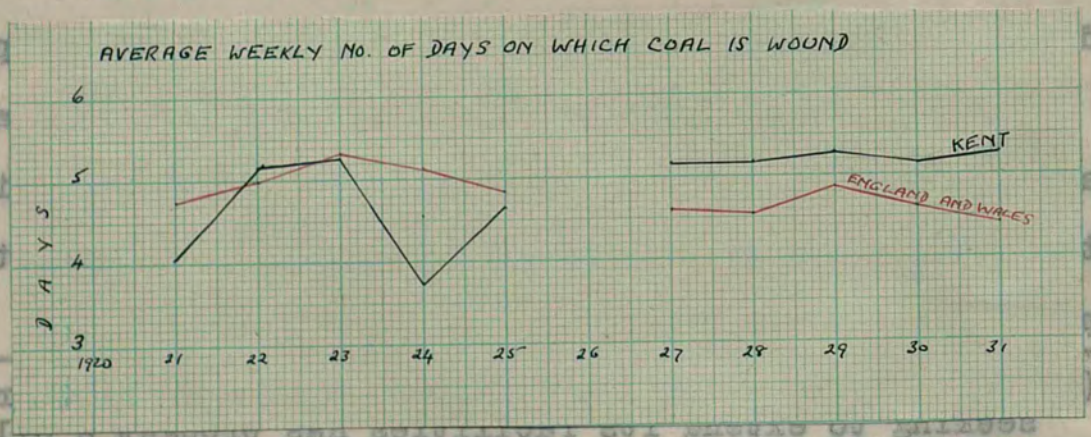

AVERAGE WEEKLY No. OF DAYS ON WHICH COAL IS WOUND
DAYS
6
5
4
3
1920
21
22
23
24
25
26
27
28
29
30
31
KENT
ENGLAND AND WALES

Fig.39.

The difference of haulage distance makes it possible to ship coal from Dover for 4d. per ton less than from Queensborough and there is an additional saving through the possibility of using larger ships, the whole saving being a very important one in the securing of foreign markets.

Despite probable future difficulties in exporting, the adequacy of transport facilities to meet existing demands, and the readiness of the markets of the field is illustrated by the high figure in the Kent coal district for the aggregate number of days on which coal was wound during the period 1927-1931. (see graph. Fig.38).

In 1931, the average weekly number of coal-winding days lost in Great Britain was 64·14 and of these, 49·31 were lost through transport difficulties and lack of trade, 9·9 through holidays, and 1·21 through accidents to men and machinery, thus showing the paramount importance of transport difficulties and lack of trade in causing idleness at the pits. In Kent the 1931 figure shows an increase in the number of days on which coal was wound as opposed to the general decrease in England and Wales.

Chapter III.

NON-AGRICULTURAL INDUSTRY.

It has already been remarked that non-agricultural manufacturing industry of any extent, is represented in S.E. England only by paper manufacture, cement manufacture, and brick, tile and pottery manufacture. There are various other small industries such as the manufacture of certain chemical products and glass, and, in addition, a certain development of industry in connection with transport, but the characteristic industries of the area are those previously referred to, and it has already been shown that there is a growing intimacy between the paper and cement industry and the new coal industry.

Brick and tile manufacture is the only industry characteristic of the three counties, though in the past both cement and paper manufacture has been common to them all. Paper manufacture is confined wholly, and cement manufacture almost wholly to Kent and, in general, to that part of Kent bordering on the Thames and Medway. This area constitutes the only highly developed industrial region of the SE.

Information as to the numbers employed in each industry at the 1931 Census are not yet available. The only material[1]

(1) This is, as yet, unpublished.

it has been possible to obtain relates to the numbers engaged in various occupations in urban and rural districts, and whereas in the case of the mining industry and of agriculture, occupational figures give a very fair indication of the total numbers employed, they represent but a fraction of the employment in most other industries. If, however, the ratio between the numbers returned as occupied in each industry and the total number employed in each industry be assumed to be the same as in 1921, an estimation of the present employment figures may be arrived at. It is unlikely that the ratio between the various classes of workers in each industry has varied greatly during the decade 1921-1931 except in the case of cement manufacture where rationalisation has proceeded to a very great extent and where methods of manufacture have changed considerably. The numbers of those employed in this industry has been estimated by the Works Manager of the Associated Portland Cement Manufacturers and represent the approximate number of those at present employed in that firm, in the British Portland Cement Manufacturers and in the few smaller works remaining outside these combines.

TABLE X.

The Total Number of Persons employed in Paper, Cement, and Brick, Tile and Pottery Manufacture in Kent, Surrey and Sussex in 1921 and 1931.

	Kent		Surrey		Sussex		Total		Inc. or Dec. %
	1921	1931	1921	1931	1921	1931	1921	1931	
Paper	8752	13000	192	-	22	-	8966	13000	+44·8%
Cement	8343	3500	121	-	467	-	8931	4000	-55 %
Brick, Tile & Pottery	3429	5070	946	1450	1212	1860	5587	8380	33·3%

The size and rapid growth of paper manufacture place it foremost among Kentish industries. The very big decline in the numbers employed in cement manufacture is no indication of the size and importance of the industry but rather of changes in methods of production whereas the increase in the numbers engaged in the brick and tile industry reflects the general urbanisation of the area and consequent housing development, rather than growth in the industry's relative importance.

The Paper Industry.

Kent is generally believed to be the home of the paper making industry in England, and though it seems impossible that paper was not being made earlier, tradition has it that the first English paper mill was built at Dartford by Sir John Spilman, Queen Elizabeth's jeweller. A fool's cap formed part of his coat-of-arms and he probably used it as a watermark and was thus responsible for the origin of foolscap papers. What is more certain, however, is that paper was being made at Snodland in 1600, and at Eynsford in 1699. The craftsmen were mostly Huguenots and Hollanders who brought the industry from the Continent where it was much more highly developed. During the next century the industry grew and centred round the small streams of the upper and middle Medway valley, with a smaller development in the Stour and Dour valleys. Later development spread down the rivers to creek locations and, of recent years, development has been confined to the Thames estuary with the exception of the mill at Aylesford which has a lower river valley location. In 1857 (the earliest year of which there are records) out of about 500 mills in England, Kent had 41, Surrey 11 and Sussex ' . In 1932, the total figure was 211, and of these 35 were in Kent, 1 in Sussex and none in Surrey except a board mill at Merton. Thus although the number of Kentish mills has decreased, there has been a gain in relative importance, a gain all the more marked when the size and output of

the mills is considered. (see below).

Much of the interest of the Kentish industry lies in the fact that there is here a complete range of type. Mills still flourish, occupying the sites, and in some instances the buildings of the early mills, where paper making remains a craft and the weekly output consists of one to three tons of the highest grade hand-made papers. At the other end of the scale, the Thames estuary has seen the latest developments in the industry and here are mills with the largest, fastest modern machinery producing up to 4,000 tons of cheap-grade papers per week.

The importance of the region in the paper industry is due to a combination of geographic factors, the relative values of which have changed with the growth and changes in method in the industry, but whose total value has steadily grown, not only is the region more important than ever before, it is also the scene of new enterprise in the present period of general industrial depression.

Certain considerations have remained true for the whole industry throughout its development. Its location has never been determined by the presence either of raw materials or of a local market (in this respect it offers a sharp contrast to the cement industry) and its location has always depended primarily on water, first as a source of power and later as a

Fig.40. N.B. (1) The general concentration of New Mills in estuarine areas.
(2) The general location of old mills on upper and middle river valley sites (For list of Mills to which numbers refer, see Appendix, Table).

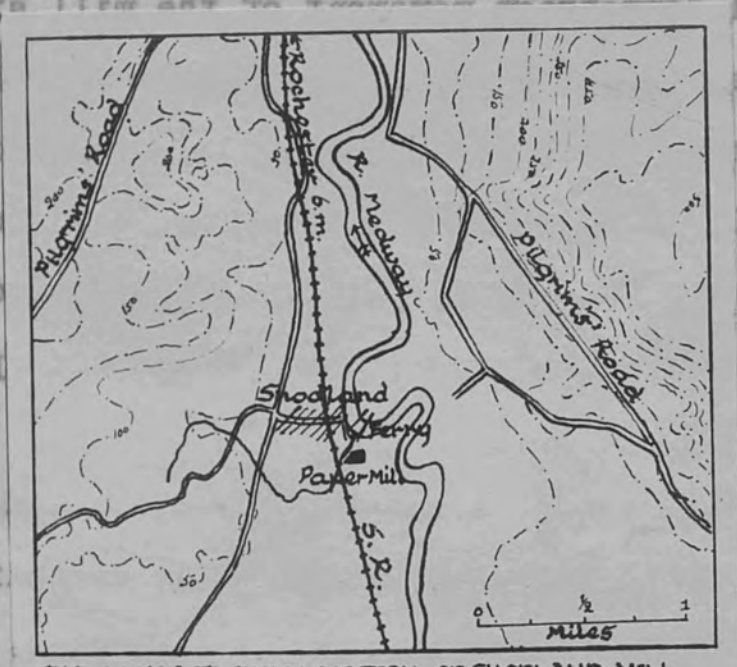
transport medium. This change in the role of water explains the general downstream movement of the mill sites.

The map (Fig.40) shows the existing mills in SE. England distinguishing between their type and age. Mills established before 1860, were, generally speaking, dependent on water for power and rags for raw material. After that date the use of steam was general and first esparto and then pulp were superseding rags.

A consideration of these mill-sites will show the underlying geographic causes both for their establishment and for their type of development.

The earliest mill of which we have records is not, perhaps, typical of early mill sites generally. It is situated at Snodland on a small tributary of the lower Medway at the point where it joins the main stream (Fig.41). From this stream it derived its water supply but the site was probably fixed in this particular region since it lies close to the Pilgrims Way, and a ford at this point offered one of the crossing-places on the Way which was an important trade route. The advantages of this site for the importation of raw materials up the Medway and its nearness to the London market have caused the mill to lose its original character and to develop into machine mill with a large output of low-grade papers.

The mills which occupy old sites and have remained almost unchanged in methods and production since their establishment are the following:-



SKETCH MAP TO SHOW LOCATION OF SNODLAND MILL

Fig.41.

N.B. (1) The location of the mill at a ferry point near the convergence of the Pilgrims' Road on the Medway.

(2) Availability of road, river and rail transport.

Ford Mill at Little Chart near Ashford, with an upper river valley location on the Stour.

Eynsford Paper Mills at Eynsford with a middle river valley location on the Darent at a point where a small stream joins the main river.

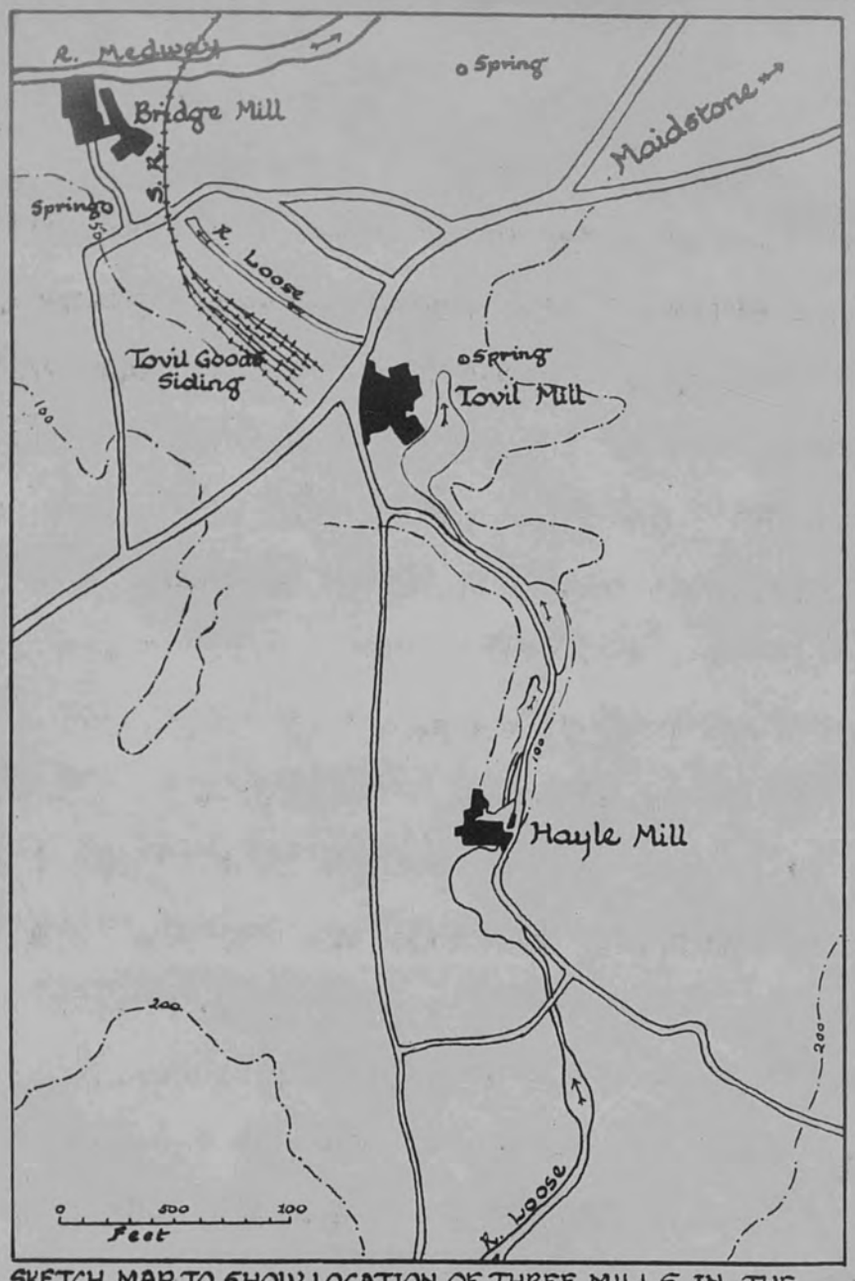
Springfield Mills on the Medway just below Maidstone.

Hayle Mill on the R. Loose, a small stream which joins the Medway at Maidstone.

These mills make the highest grade hand-made papers and though a small machine has recently been installed at Springfield, and mould machines are used to a certain extent, the bulk of the paper is still hand-made and methods generally follow those of 150 years ago.

They all owe their location to a supply of river water for power and of pure water for their processes, and the quality of their water is responsible for the quality of their papers. In the Maidstone district and at Little Chart it is drawn from abundant springs in the Lower Greensand, which are free from iron and other deleterious chemicals and are comparatively hard since the Hythe beds in this region are largely composed of limestones and calcareous sandstones (the Kent ragstone).

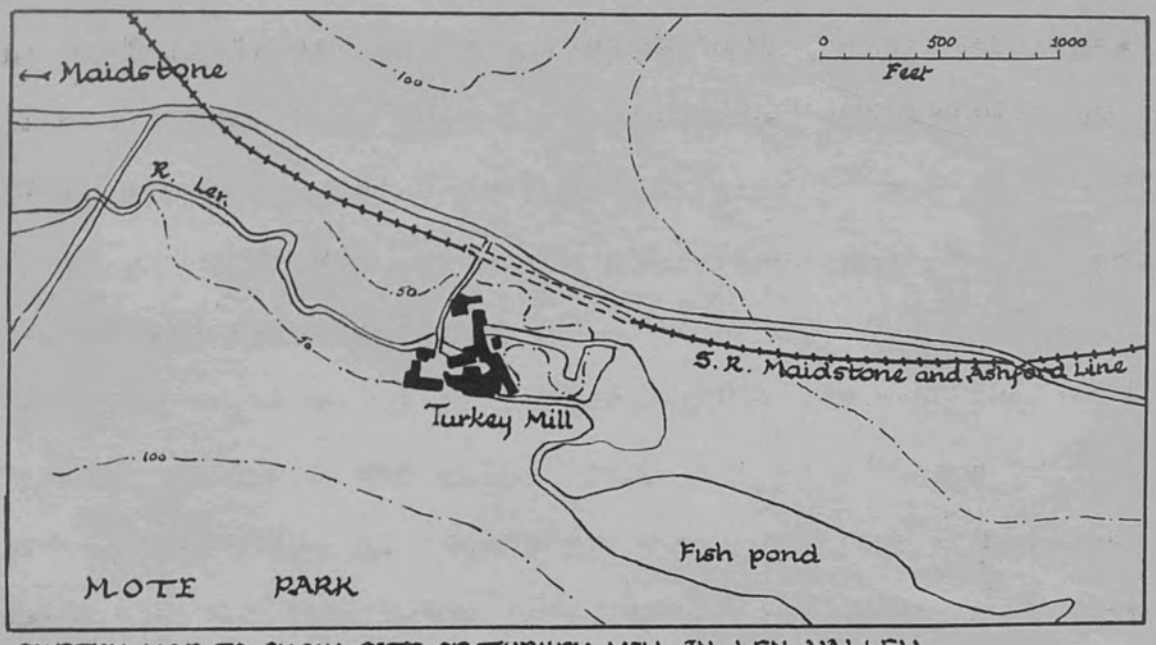
At Eynsford, chalk water gives an abundant and pure supply. The fine hard feel in the best Kentish papers is said to be attributable to the presence of limesalts in the water,



SKETCH MAP TO SHOW LOCATION OF THREE MILLS IN THE LOOSE VALLEY NEAR MAIDSTONE

Fig.42.

and the necessity for pure water in the manufacture of fine papers is obvious. The amount of water power available at these sites was not sufficient to keep pace with growth in production, but it is still used at Hayle, Eynsford and Little Chart to supplement the main steam and electric supply. At Hayle sufficient electricity is generated from the Loose stream to light the mill. This mill affords generally an interesting example of the early mills and its site is worth a more detailed examination. It stands in the narrow, comparatively deep Loose valley at the head of the 100 ft. contour which here narrowly encloses the stream. The water supply for the processes is derived from springs higher up the valley. Part of the equipment of a mill which makes high-grade paper is a drying loft where the paper is hung up, sheet by sheet, on cow-hair ropes, to dry in the air, since by this means alone can an even contraction be insured. At Hayle, the drying loft with its louvred sides is built across the valley so that it may take advantage of down-valley draughts. In wet weather the louvres on the wind-ward side are closed and by this method the maximum amount of air is obtained at all times. This type and position of loft was observed also at Turkey Mill in the Len valley (see Fig.43) and a study of large scale maps suggests that it occurs also at many of the old mills such as Ford, Basted, Chartham, Roughway etc.



SKETCH MAP TO SHOW SITE OF TURKEY MILL IN LEN VALLEY

Fig.43.

The raw materials used are cotton and linen rags. The cotton comes mainly from Lancashire and the linen from Belgium and N. France, and they come to the mill by rail and road, the linen usually entering the country at Dover. There is an absence of direct connection at the mill with either rail, main road, or navigable waterway and the paper has to go by road to the goods station at Tovil and thence by rail to the docks for export, or to its ultimate destination. Both the raw materials and the paper produced are sufficiently high priced, however, to eliminate the necessity for very cheap transport and a similar lack of direct transport facilities is observable at Eynsford and at Little Chart. Springfield mills are more favourably placed, lying between the navigable Medway and the main Maidstone-Rochester road, and this may have contributed to the fact that to-day this is the biggest mill of its type.

In considering the next group of mills, those which occupy old sites but which have changed in their methods and types of product, it will be shown that the existence of better transport facilities is general.

The group needs dividing into

(1) those which still produce high-grade rag papers but which use machinery, i.e. those which have departed from their original character in methods rather than in types of production and to whom as a consequence, cheap transport is still a

secondary, and the quality of the water supply a primary consideration.

(2) those which produce cheaper grades of paper made by machine from esparto and pulp. Some mills, of course, occupy an intermediary position and use both rag and pulp.

To the first group belong Turkey, on the Len, about ½ mile out of Maidstone on the Ashford road; Chartham on the Great Stour, 3 miles S.W. of Canterbury, Basted near Ightham on an upper reach of the Shode tributary of the Medway; East Malling mills near the head of the Leybourne, a small tributary of the lower Medway. Here too belongs the Sussex mill at Iping near Midhurst.

All these sites show very similar characteristics to those of the hand-made paper mills. Turkey, Basted and Chartham still supplement their power supply with water power. The position of their drying lofts has already been noticed. Turkey, Basted and East Malling are all on the Lower Greensand, and draw their water supply from springs in that formation, while at Chartham chalk-water is used. Their machines are small and slow-moving and their output correspondingly small and high-grade.

To the second group belong Tovil mill on the Loose below Hayle; Snodland Mill (whose location has already been discussed), Dartford Mills on the lower Darent (traditionally the first mill site), Hawley and Horton Kirby on the middle reaches

of the Darent. St Mary Cray[1] in the upper valley of the R.Cray and Roughway on the Shode below Basted. At Lower Tovil mills near the junction of the Loose and the Medway; Buckland mills in the Dour valley and the Cray Valley mills near St Paul's Cray, both rags and pulp are used.

At Tovil and Snodland the opportunities offered by the Medway, and at Dartford by Dartford Creek for the cheap importation of esparto and pulp have caused the introduction of fast-running machines for a large output of lower-grade papers. Horton Kirby is the highest point on the Darent where machine-made paper is made. It has no water-transport facilities and its output of esparto papers is of a higher grade than that from Tovil, Snodland and Dartford. At Roughway there is a somewhat specialised type of trade since here and at Hamstead mill near Yalding (built later), wrapping papers are made for the rest of the mills of the group to which they belong. Their output is small.

At Buckland Mills (with which is associated the more recently built Conqueror Mill) and at St Paul's Cray there is an absence of water transport facilities, and though their output is large and varied it is on the whole high-grade.

All the mills already considered illustrate either the old phase of the industry or the new phase superimposed on the old.

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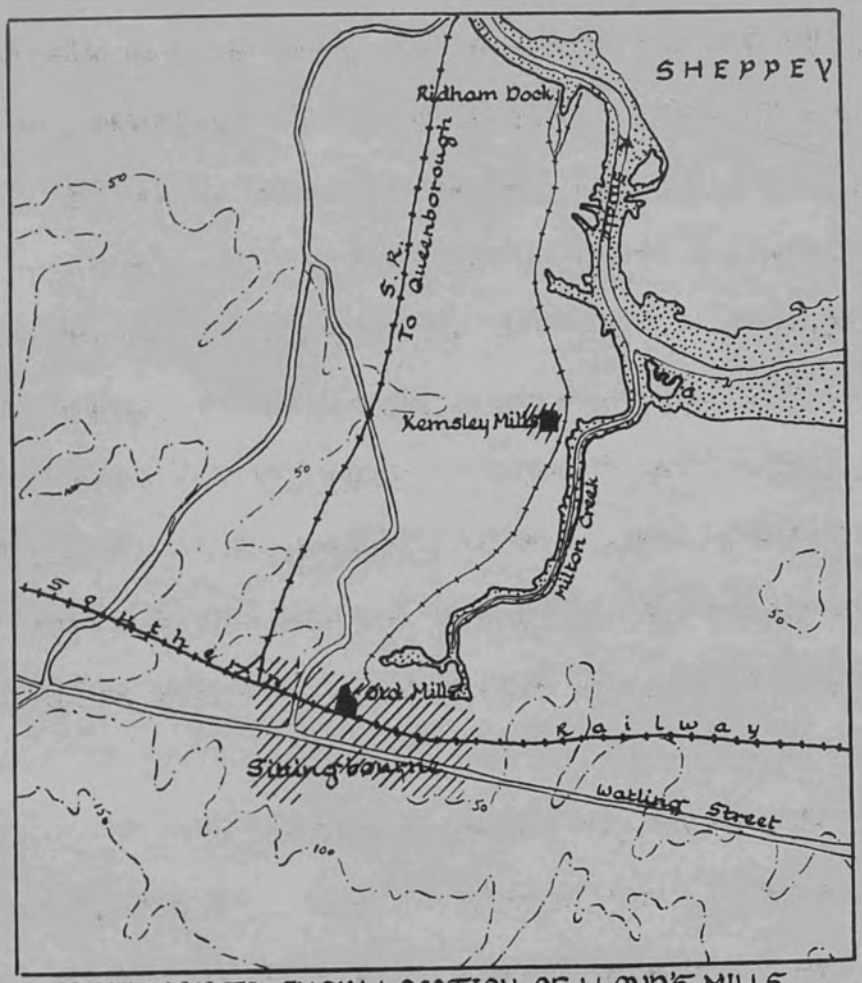
(1) These mills closed down in 1930, but are likely to be reopened in the near future.

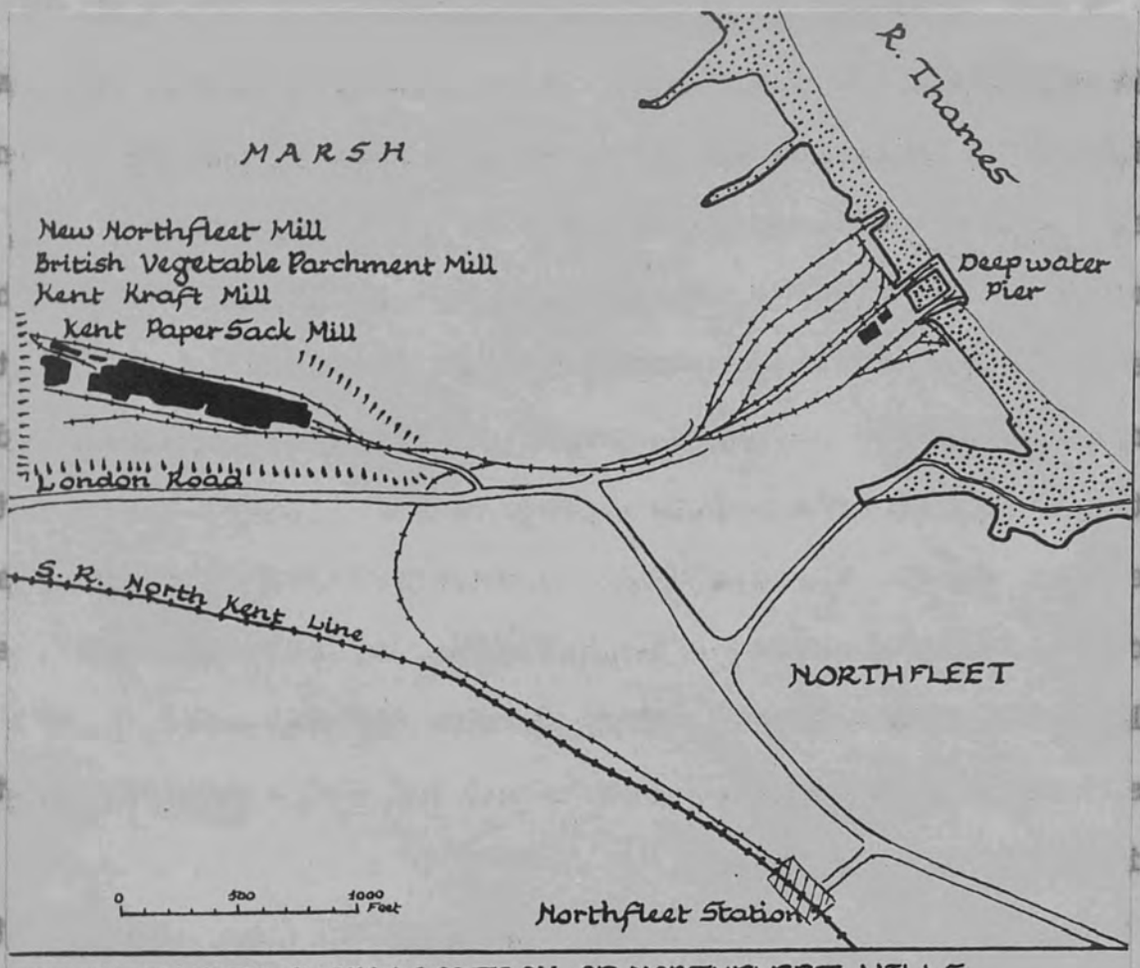


SKETCH MAP TO SHOW LOCATION OF LLOYD'S MILLS

Fig.44.

While, of course, the change from handwork to machinery was due primarily to inclination on the part of the mill-owner and there seems no other reason why, for instance, machinery should have been installed at Turkey and not at Hayle, yet in the main the influence of water conditions on the development of the mills can be traced. In the choice of mill sites after the industry entered on its modern phase, facility for water transport has been the dominating factor. There are three centres of modern growth, Sittingbourne, Greenhithe-Northfleet-Gravesend, and Aylesford, while the Dartford centre was extended by the establishment of the London Paper Mills and the Maidstone centre by Bridge Mills at Tovil.

With the development of machinery and the consequent rapid growth in output, the supply of rags proved insufficient and in 1865 esparto was introduced as a raw material. In 1870 Lloyds Mills at Sittingbourne were opened. These mills which were started for the manufacture of newsprint for a London group of newspapers, to-day form the largest and finest equipped mills in Europe. The site allows for the direct import of raw materials and the direct export to the London market (Fig.44). Originally Milton creek afforded the means of this transport and the chief trade was the import of esparto from the private Algerian estates of the mill. Later when pulp superseded esparto in the manufacture of newsprint, pulp mills were acquired at Honefos and Vittingfos in Norway and Ridham



SKETCH MAP TO SHOW LOCATION OF NORTHFLEET MILLS

Fig.45.

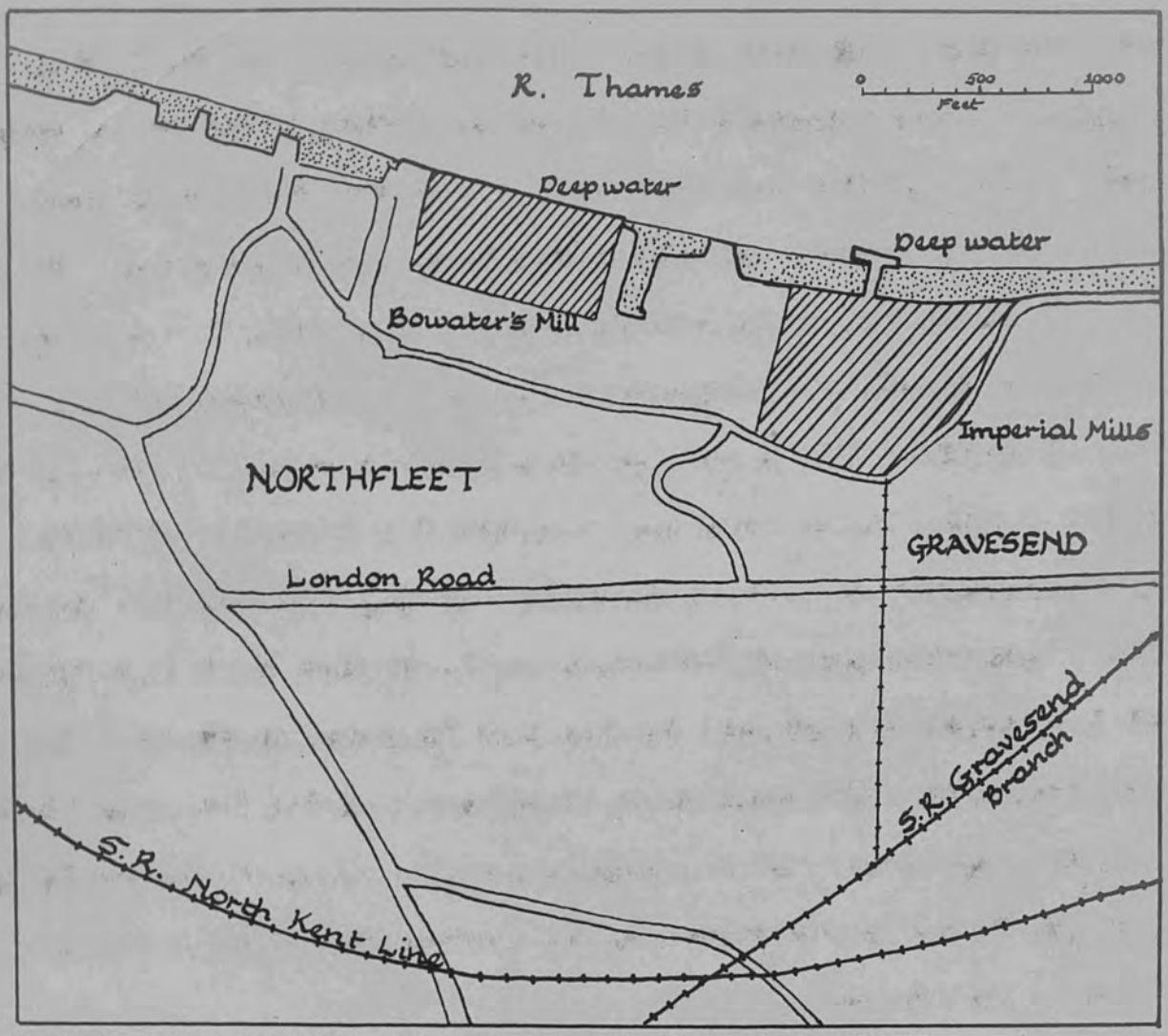
N.B. These four mills occupy adjoining sites in a shallow chalk excavation. The actual plan of the buildings shown is not accurate.

dock was built to which come small steamers direct from the pulp mills; supplies of china clay (which is needed to 'load' cheap papers) from Cornwall; and of coal and timber. A new mill was built at Kemsley and here a certain amount of pulp itself is manufactured. Both mills are connected by narrow-gauge railway to the dock, and the bulk of the paper is despatched by barge to London or the London docks.

The Greenhithe-Gravesend-Northfleet group of mills were a definite response to the introduction of pulp and the growing demand for cheap paper. What is now the New Northfleet Mill is an historic mill, since here, about 1882, Dr Eckmann carried on his experiments for making sulphite pulp. No pulp is made here now, however, and esparto, as well as pulp, is used.

All these mills have access either directly, or by private railway, to deep water wharves on the Thames, and the advantages possessed by the Thames estuary for imports of Scandinavian origin is obvious (a little Canadian pulp is used, but the bulk is from Finland, Sweden and Norway).

The Northfleet group (see Fig.45) are connected with a wharf giving access to 5,000 ton steamers. At the Empire Paper Mills at Greenhithe a jetty extends 450 ft. into the Thames with a frontage of 605 ft. giving sufficient water at L.W.O.S.T. for ships of 18 ft. - 24 ft. draught. At the Imperial Paper Mills (Fig.46) a similar jetty gives equal shipping facilities.



SKETCH MAP TO SHOW LOCATION OF TWO THAMESIDE MILLS

Fig.46.

N.B. The rail connecting the Imperial Mills and the Southern Railway is diagrammatic.

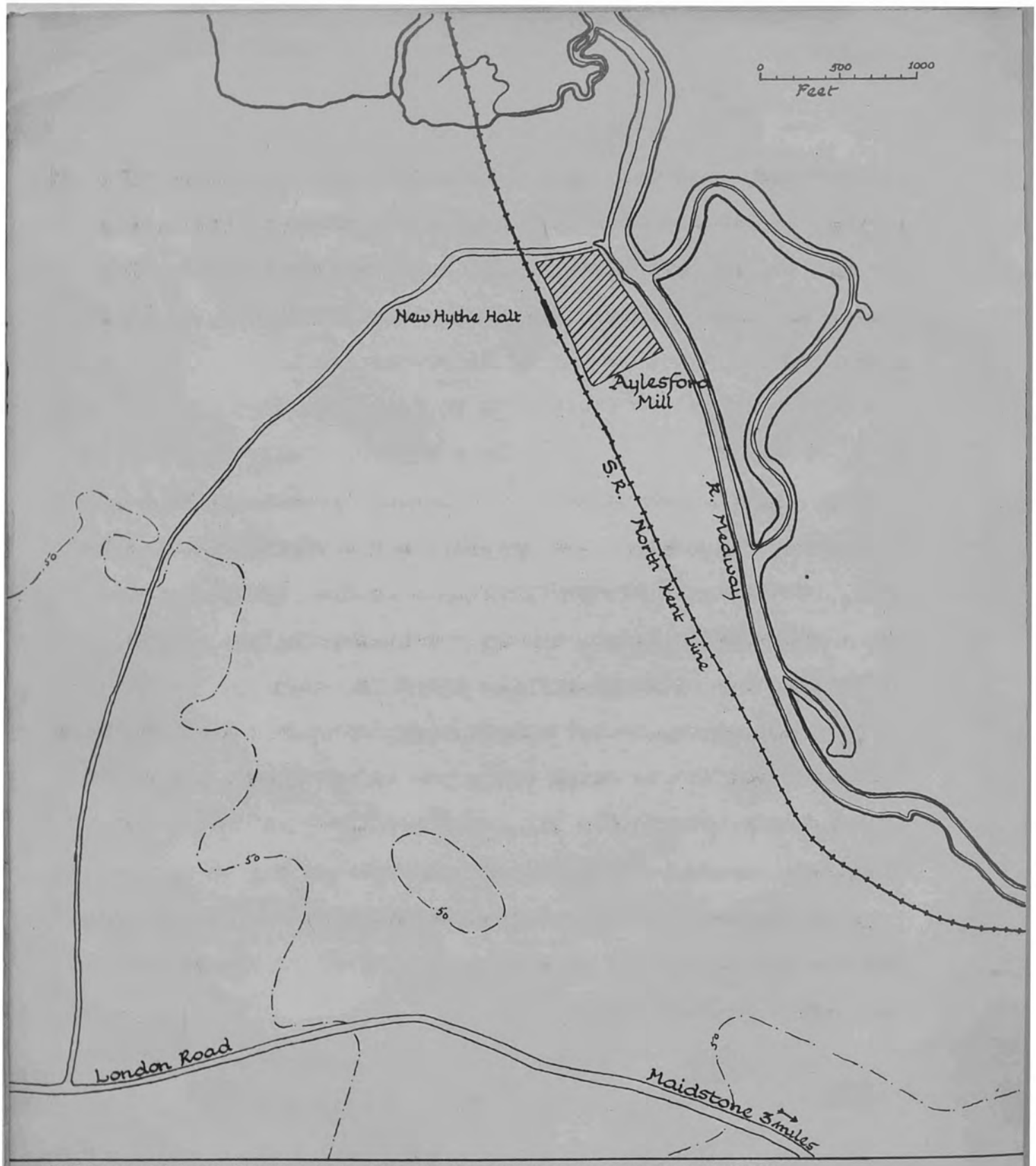
At Bowaters, the most recent Thameside mill built in 1926 (Fig.46), the emphasis is placed so strongly on river transport that the frontage has been built out to deep water, ships of 2,000 tons can be accommodated alongside the mills and finished paper is run on conveyors straight from the mill to barge or steamer. There is no rail transport at all.

Aylesford Mills on the Medway are the only recently built mills (1922) which have not a Thameside location (Fig.47). Here, however, all raw materials are imported up the Medway. The disadvantages of the extra costs caused by transhipment at Rochester are offset by the low land-value of the site and the fact that although only 30 miles from London, the higher London wage-rates do not obtain here. Finished paper is mostly rail and road borne since these routes are direct and the water route circuitous.

The London Paper Mills at Dartford and Bridge Mills at Tovil both have riverside locations allowing for barge import of raw materials, and in general character they resemble Dartford and Tovil mills.

At all these mills the quality of the water supply for the varicus paper-making processes is of little importance, but it must be plentiful and river water, well water, and spring-water are all used. At Bowaters two wells were sunk, one into the chalk which gives a copious supply for the processes, but was found unsuitable for the boilers. A second well was sunk

Fig.47.



SKETCH MAP TO SHOW LOCATION OF AYLESFORD MILL ON R. MEDWAY

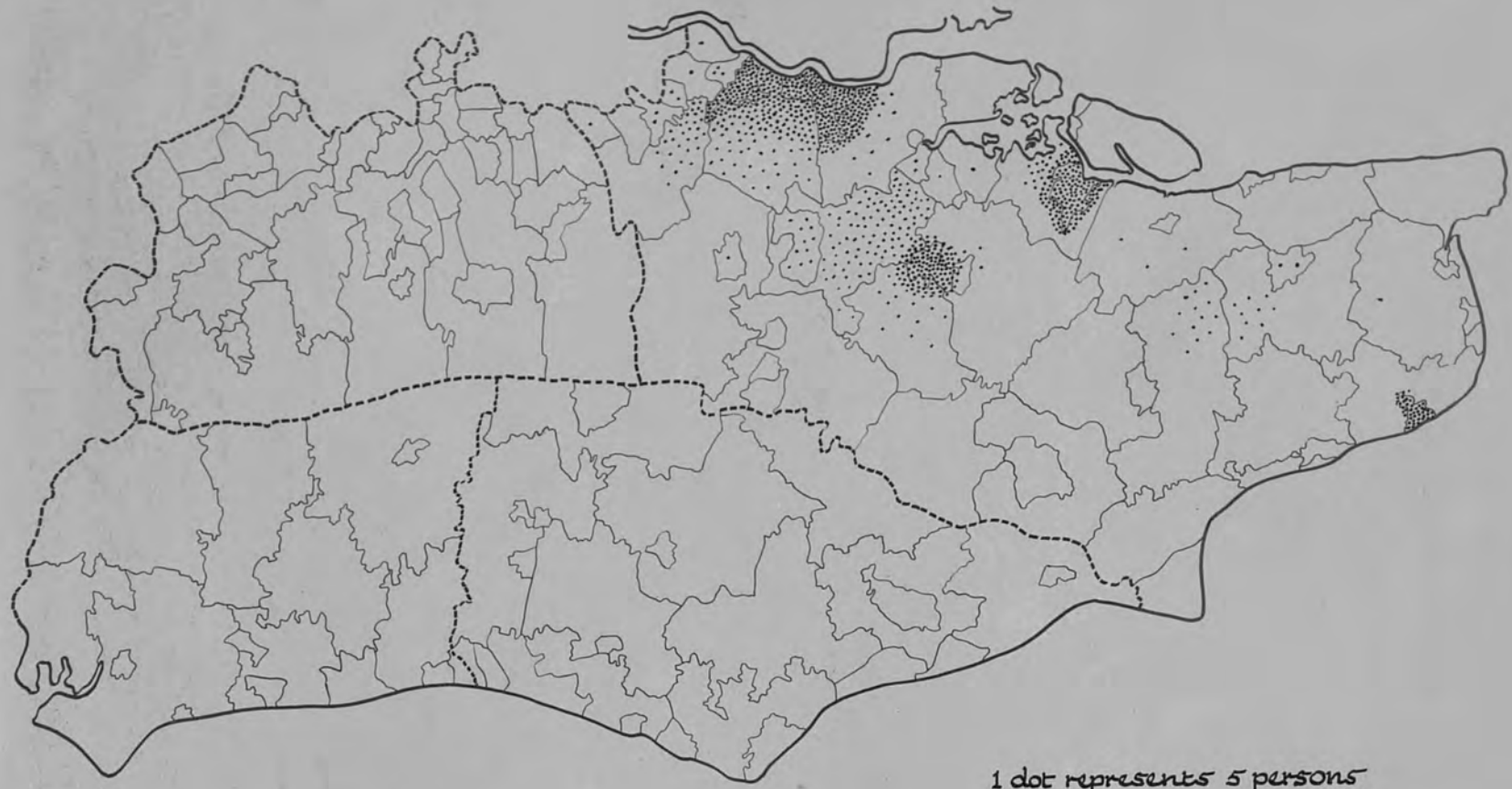
Fig.47.

900 ft. deep into the Lower Greensand to obtain a more suitable supply for this purpose and large quantities of river water are used in the condensing plant. At Aylesford, little importance is attached to the nature of the water, provided there be sufficient.

Labour.

The general diversity of the paper industry is reflected in the varying numbers and types of workers employed in each mill. They range from the craftsmen of the hand-made paper mills who serve a seven-year apprenticeship before they are considered sufficiently skilled for their work, to the unskilled labour which forms an increasingly large proportion of the employees in the large mills producing low-grade papers.

The following table shows the number of men and women occupied as paper-makers in 1911, 1921 and 1931. This does not represent the total number employed in the industry, but demonstrates its growth and the relative importance of male and female workers.



DISTRIBUTION OF MAKERS OF PAPER AND CARDBOARD 1931

Fig.48. Note (a) Big paper-making population of Thames and Medway areas.
(b) Smaller concentration at Dover and in Rural areas. (For key to districts see Fig.2).

TABLE XI.

Paper Makers in Kent.*

1911		1921		1931	
Male	Female	Male	Female	Male	Female
3204	1573	3919	1354	4611	1372

During the last ten years, the industry has grown as an absorber of labour but little or none of this expansion has included the craftsman type.

The distribution of paper-makers is shown in Fig.48. The Dartford-Northfleet-Gravesend area shows the biggest concentration, while Maidstone and Sittingbourne rank second and Dover third. The small mills near Sevenoaks and Ashford etc. account for a scattered distribution of workers in rural districts.

The mass of the workers forms part of the general population of the towns and villages. An old mill like Hayle, however, occupying a somewhat isolated position in a small valley has resulted in a small colony, almost exclusively of paper makers,

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* The 1931 Census differs from previous Censuses in not including unskilled workers under the various occupational headings. To make figures comparable, therefore, unskilled labourers have been assumed to occupy the same ratio to skilled workers as they did in 1921 and the figure for 1931 adjusted accordingly. It results probably in an underestimation, since growing big-scale production is likely to have caused a bigger increase in unskilled than in skilled labour.

settling in cottages around it. At such a mill, where rags are used, there are as many women as men employed. This, together with the fact that here craftsmen are needed, and craftsmanship in paper-making, as in many other industries, tends to run in families, stabilises the labour supply for the mill and fixes, to a certain extent, the occupational outlook for the valley. As would be expected, there is a growing tendency to departure from traditional employment, but young craftsmen may still be found willing to enter their apprenticeship.

Another form of paper-making colony exists at Kemsley. Here, to provide accommodation for a big labour supply, rapidly increased with recent mill developments on a lowlying area behind marshland where population was thin, a modern garden village with facilities for social activity has been built by the mill-owners. This type of settlement has not developed in the Maidstone, Thameside, or Dover areas where population is fairly dense. With the exception of Maidstone, the paper-making centres, in general, lie in regions of outward migration. (see Fig.6).

The labour of the industry is characterised by its suitability and steadiness. Disputes (which frequently interfere with the output of paper in Scandinavia) are unknown and the resultant steadiness of output forms one of the major advantages of the Kent region.

Female labour is extensively employed. In the mills using rags, women are employed cutting and sorting them and most of the finishing operations in both small and big mills are done by girls. A balance of employment between the sexes is beneficial to any industrial area and the problems attendant on its absence in the Kent coalfield have already been discussed.

Output and Markets.

It is impossible to obtain figures of industrial production for any county, but by considering the output of individual mills, where this has been supplied by courtesy of the respective firms, and by estimating the output of other mills on a basis of the number and size of their machines and the type of their product, some estimation of the total output of Kent may be arrived at and the resultant position of the county in the industry of the country determined.

A distinction must be made between the vat industry (hand-made) and the machine industry. In 1932 there were about 58 vats being worked in England and Wales, and of these, 32 were in Kent; 15 at Springfield, 8 at Eynsford, 5 at Hayle and 4 at Little Chart. The total Kent production of hand-made paper is about 750 tons and forms the major part of the English production. It includes all hand-made writing, drawing,

ledger, and currency papers and also special chemical filter papers. This branch of the industry was developed during the war when the supply of ashless filter papers from Germany ceased. At Springfield the famous "Whatman" papers are made. James Whatman himself owned Turkey Mill in 1770 but his successors moved to Springfield in 1806.

The demand for these types of paper is steady, its users being narrowed down to artists, engravers, draughtsmen, etc. who would not substitute machine-made papers. In many classes of work, hand-made papers, by virtue of their even contraction, are an absolute necessity. The trade therefore, dependent as it is, on the inherent skill of its craftsmen, is little affected by industrial development elsewhere. The main market is in London but a very considerable amount is exported, both to the Dominions and especially to America and Japan.

The total number of paper-making machines in England in 1932 was about 380, and of these Kent possessed 106 and Lancashire 106. This equality of Kent and Lancashire is more apparent than real since the former possesses 48 machines of the fast-running type with a web over 100 inches wide, compared with 28 in Lancashire and, in addition, among these the fastest and widest newsprint machine in Europe.

The Census of Production for 1930 published by the Board of Trade showed the paper output of the United Kingdom[1] to be

(1) The figure includes the Northern Ireland output which is very small.

as follows:-

Newsprint	650·7	thousand	tons
All other paper	749·2	"	"
Total	1399·9	"	"

Of this total the output from Kentish mills contributed probably not less than 650,000 tons, while of the 650,700 tons of newsprint, about 400,000 tons were from Kent. This predominance in the production of newsprint is, of course, due to the London printing presses, and also to the London docks, for while, on an average only 65% of the newsprint for the home market is of British manufacture, there is on the other hand an export of newsprint from the Kentish mills to Australia, New Zealand and South Africa, regions all deficient in suitable timeer for pulp. At Aylesford in 1932 this export was estimated as absorbing 25% of the total production.

The following figures show the weekly production at some of the Kentish Mills.

I. Big Mills producing cheap grades:

	Tons per week
Lloyds	3000 - 4000
Imperial Paper Mills	2400
Bowaters	2300
Aylesford	1500
Snodland	700
New Northfleet	350

II. Small Mills producing high grades:

Turkey	20 - 25
East Malling	15

III. Hand-made.

Hayle	3 - 4
Little Chart	1½ - 2.

Besides newsprint, every conceivable type of paper is produced. Some mills specialise and others produce a great variety. At Bowaters only newsprint is made and the very modern nature of the mill is illustrated by the fact that the total output of some 2,300 tons per week is produced from only 4 machines. At Imperial Mills and Lloyds there are 13 and 20 machines respectively. These two mills make printing papers as well as newsprint. The British Vegetable Parchment Mills specialise in a kind of grease-proof paper extensively used to wrap lard and butter; while at Lower Tovil all types of coloured papers are made. At the majority of mills, however, a great range of papers is made. A recent development of the industry, centred particularly at Aylesford, has been the manufacture of Kraft papers. These papers have, until recently, been almost entirely of Swedish origin since the red-wood (Pinus Sylvestris) pulp from which they are made is short-fibred and considerably weakened if dried and exported and then rebeaten. They are, therefore, more usually made from "wet pulp" at the pulp-mills. A method of beating the dry pulp without further weakening the fibres has been discovered and the industry, under a heavy tariff protection, was started at Aylesford. At this mill there is now an output of up to 500 tons of Kraft paper per week and a mill for the production of Kraft has been built at Northfleet (Fig. 46). This development is particularly interesting since, in contrast to the bulk of Kentish paper, it supplies

a large local market. It is increasingly common for fruit and vegetables to be sent to market in non-returnable containers and for cooking-apples and potatoes especially paper sacks are being widely used. Similarly paper sacks are displacing hemp as cement containers. At Aylesford and at Northfleet factories for the manufacture of these sacks have been established. This connection between Kentish industries is further exemplified by the manufacture of strawberry baskets ay Aylesford. The baskets are moulded out of pulp and can be made at a very low cost and though they have not such an attractive appearance as the 'chip' and the fruit does not drain in them so easily, there is a considerable local demand for them.

There are various other subsidiary products at the mills ranging from corrugated paper and boxes, to toys stamped out of pulp and sprayed with cellulose paint - these find a home market in the cheap multiple stores.

The industry is still expanding. At Dartford a new mill is being established alongside the existing Dartford paper mills. The site was chosen because of its accessibility by water and here it is proposed to start the manufacture of grease-proof papers early in 1933. This class of paper has been almost entirely manufactured on the Continent until now, and a Belgian firm is cooperating with an existing English one in this undertaking, which may partly be attributed to the

recent tariff introductions. It is also proposed shortly to reopen the St Mary Cray Mill for the manufacture of vegetable parchment papers. This again is being carried out with the co-operation of a Belgian firm.

Transport.

Although the question of transport has already received considerable attention, there are certain general considerations which may be summarised.

In the case of the big mills, the tendency is for all raw materials to be water borne. These comprise esparto, pulp, china clay, and rosin (mostly from Norway). Where docking facilities are exceptionally direct as at Bowaters and the Imperial Paper Mills, coal is also water-borne. The finished products for the most part go by land, an exception being furnished by the cheapest grades, i.e., newsprint which may go wholly by water, as at Bowaters (where transport is by barge in the hands of a subsidiary company), or partly by water as at Aylesford. Newsprint for the provincial market, however, mostly goes straight to its destination by rail. Whether the paper shall go by road or rail depends (1) on the particular facilities offered by each at the mill, (2) on the type and size of the consignments. With the exception of Bowaters the big mills have direct connection with the rail, and bulky consignments are mostly sent by rail, but road transport is

increasingly popular because of its directness and speed. The tendency is for the mills to act as storage depots and to send out a large number of small consignments to the wholesale stationers. This relieves the latter of the necessity of holding large stocks and of finding storage room for them but it is only possible where the transport system is rapid and flexible. At the small mills, such as Turkey Mill, where there is no direct rail connection, the London market is supplied wholly by road. In the case of a mill with a very small output, such as Hayle, rail transport is again utilised, since there is not sufficient employment for a lorry service.

The question of the utilisation of Kent coal in the paper industry has already been dealt with to some extent in Chapter II.

At the present time it is definitely controlled by facilities for water transport. With the existing low freights coal from E. coast ports can be obtained in the Thames more cheaply than rail-borne Kentish coal and as a result, mills such as Bowaters which possess direct dock connection use no Kent coal. Where however, E. coast coal would have to be transhipped into barges, as for delivery at Aylesford or Tovil, or carried some distance in trucks from the wharf as at Northfleet, it is displaced by rail-borne Kent coal. Where rail-borne coal is inevitable, as at Turkey Mill, it is also utilised.

The growth of the consumption of Kent coal in the paper industry seems, then, to depend on the balance of the prices and freight rates of Kentish and North-country coals.

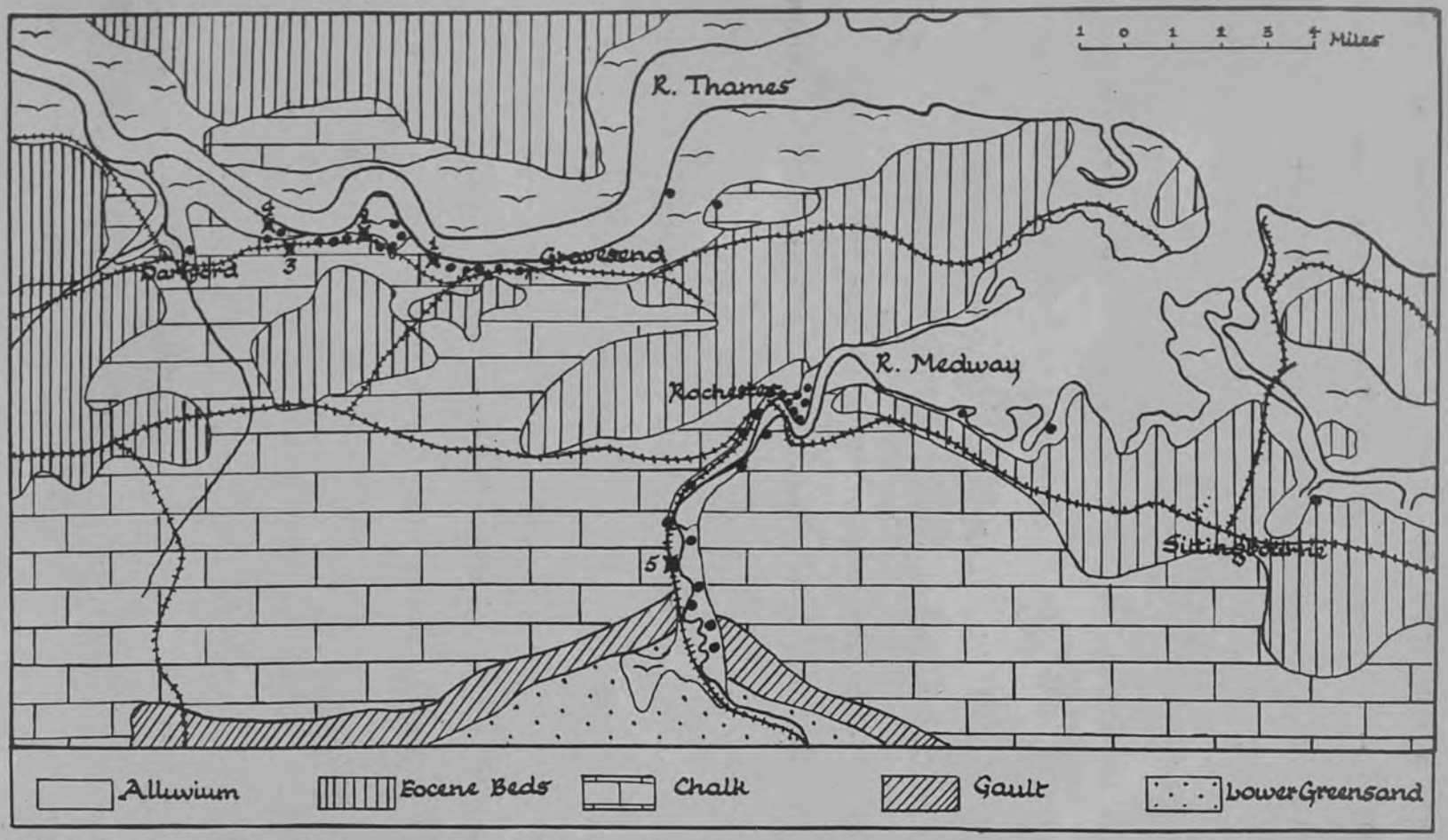
The Cement Industry.

The history of cement manufacture in S.E. England is more recent than that of paper-making but, like the latter, it has had two distinct phases, an old, associated with the manufacture of Roman and other types of cement and a modern, concerned mainly with the production of Portland cement. During both periods the industry has been located primarily by the presence of its raw materials and these, being comparatively widespread within the region, allowed centres of cement production to be correspondingly widespread, subject to certain limiting transport considerations. Of recent years, the growing necessity for cheap transport has concentrated production at certain especially favourable localities. In 1910 there were over 40 works in the Thames-Medway region. In 1933, although output had much increased, it was almost all produced from 5 works.

In 1756, Smeaton the engineer who built Eddystone lighthouse, discovered that he could make a much better water-resisting cement by using impure limestones, than by using the purest, hardest limestones which had hitherto been considered necessary, and he concluded that certain admixture of clay was an advantage in the manufacture of cement. In 1796 James Parker discovered that there were certain rock deposits which were composed of a suitable mixture of lime and clay to

produce an hydraulic cement when calcaried. These were the septarian nodules found embedded in the Tertiary deposits of the Kent coastal region and more especially in the London Clay of the Isle of Sheppey. Parker called his invention "Roman Cement" and cements of this type were in very general use during the early part of the nineteenth century. In 1816 works were established at Faversham and Sittingbourne, near the septarian deposits of Sheppey. At Swanscombe also early works were established for the production of this and other early types of cement. Though the manufacture of this cement never developed into a large industry, it grew considerably until later in the century its place was gradually taken by Portland cement.

The septarian nodules constituted a restricted and expensive raw material and it was the many attempts of inventors to discover a cheaper and more plentiful source of supply which led to the discovery of Portland cement. Joseph Aspdin, a bricklayer of Leeds, discovered that by mixing finely pulverised lime with clay in certain proportions, burning it at a high temperature and grinding the product, he was able to make an hydraulic binding material far superior to any cement then existing. A similar type of discovery at the same period was made by Frost at Swanscombe and in 1825 he started producing what he called "British cement" at these works, and here cement is still being produced to-day, (the works were later



SKETCH MAP TO SHOW THE LOCATION OF THAMES AND MEDWAY CEMENT WORKS

• WORKS NOW CLOSED ✖ WORKS STILL PRODUCING.

Fig. 49.

Note (a) Greater number of old cement works.
(b) Location of present producing works almost completely confined to Thameside.

acquired by Messrs J.B. White & Son).

Aspdin called his cement Portland cement because of its resemblance to Portland stone. During the succeeding years it was gradually improved and its production became less and less empirical until to-day it may be considered as constituting a branch of one of the chemical industries.

Works sprang up along the Thames and Medway[1] estuaries and lower valleys, where there were ample supplies of chalk and clay and water for the manufacture of the new product, and also river communication of a varying degree of usefulness. Among the first of these factories were those of Messrs Hilton, Anderson, & Co. at Halling and Upnor (the owners of the "Roman" cement works at Faversham); Messrs A.Francis at Cliffe; Messrs W. Aspdin at Northfleet (later carried on for many years as Robins, Aspdin & Co.: Messrs Knight, Bevan & Sturge at Northfleet, etc., etc. The distribution shows a wide range, but early emphasis rested on the Northfleet region. Besides this main Thames-Medway producing area, there were subsidiary producing areas along the North Downs in Surrey and the South Downs in Sussex. Up till recently cement was produced at Beddington in Surrey but now all production in that county has ceased. In Sussex of early centres at Amberley, Newhaven, Upper Beeding and Lewes, only Upper Beeding and Lewes are at present productive.

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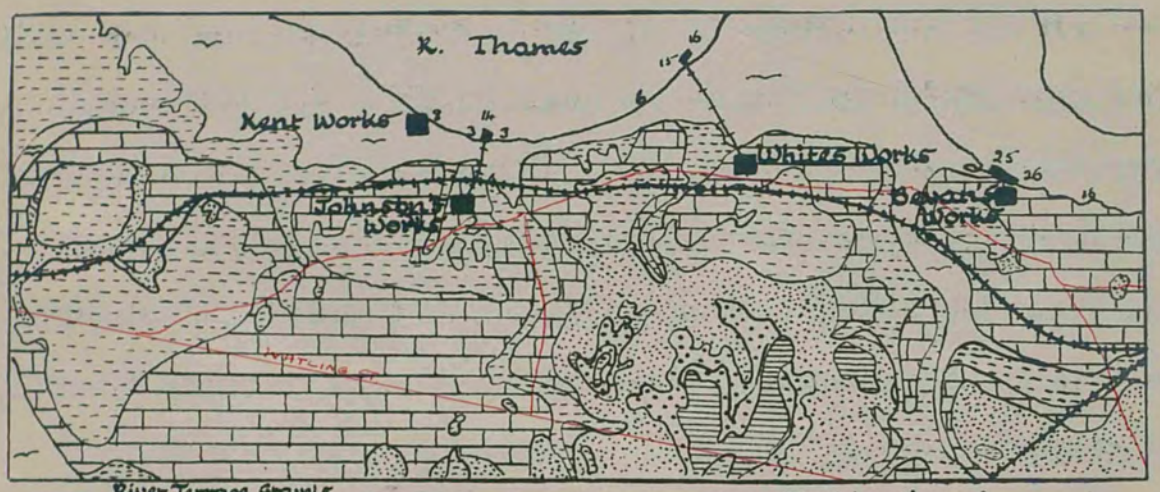
(1) Fig.49.

In the beginning of this century many of the cement works combined and the two amalgamations of the Associated Portland Cement Manufacturers Ltd., and the British Portland Cement Manufacturers Ltd. were formed. The process of amalgamation has continued, and from time to time various subsidiary groups have been formed; but to-day practically all the works in S.E. England belong to one or other of the first two groups, which are themselves closely connected and have a joint selling organisation, with the Cement Marketing Board.

After this short sketch of the history of cement manufacture, a more detailed consideration will be given to the present location and characteristics of the industry in Kent and Sussex.

The fact that Portland cement was invented in this country and the presence in the Thames-Medway estuary of unlimited quantities of suitable raw materials gave to this region a virtual world monopoly in production and a consequent big export trade which increased as the new product grew in popularity for constructional purposes. It was a state of affairs which could not last, since cement can be made of a great variety of raw materials in fact, from any form of lime and a lumina-silicate properly blended, substances which are very widely distributed. It is a heavy cheap commodity and its transport over long distances could not persist. Importing countries began to manufacture their own supplies and the



SKETCH MAP SHOWING SITES OF THAMESIDE CEMENT WORKS

Fig.50.

Note (a) General control of location by Chalk outcrop and nearness to river.
(b) Favoured position of Bevan's Works in this respect.
(c) Location of Kent Works controlled by nearness to waterside and not by chalk outcrop.

United States, originally the biggest customers, rapidly developed her own industry and became self-sufficing towards the end of the century. In face of this strong competition the home industry had to be reorganised and rationalised to give the utmost economy in manufacture and lowest possible costs of production. Deep water and consequent superior marketing facilities have concentrated the major production at a few points on the Thames. Present sites are intimately connected with their markets.

*The present producing works are Kent, Johnson's, White's, and Bevan's on the Thames at Greenhithe, Swanscombe and Northfleet; Holborough Works near Snodland on the Medway; Upper Beeding works on the Adur near Shoreham and Eastwood's works at Southerham on the Ouse near Lewes. The first six of these works belong either to the A.P.C.M. or to the B.P.C.M. and the first four are immeasurably more important than the others, or than any other group of cement works in the country.

The location of the Thameside works with regard to the geology and general communication lines is shown on the map, Fig.50. Johnson's, White's and Bevan's are old-established but have been completely rebuilt to allow for the modern type of production by rotary kilns and Kent Works were not built until 1919-1921.

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*N.B. Much of the information for this chapter was supplied by the Works Secretary of the A.P.C.M.

The chalk is everywhere to hand. The whole of this region is pitted with quarries, many of them old and disused. The abandonment of a quarry is determined by two factors (other than the closing down of the works to which it belongs). It is abandoned when the limit of the company's property is reached, this is the more common reason, or when the overburden becomes too deep for the quarry to be worked profitably.

The chalk here used is the Upper White Chalk-with-Flints and the overburden, being either the natural loamy chalk-soil, alluviums, or clayey gravels, is usually of a clayey nature and where it is not too deep, is fed with the chalk into the wash-mills. The upper division of the chalk offers special advantages since it is sufficiently soft to be quarried by steam navvies whereas the lower and harder chalks more often require blasting. The flints, which are very plentiful, are left behind in the wash-mills and some are sold for road-making, but the bulk are calcined and used as a white aggregate for the white cement necessary for the manufacture of pure white concrete.

The clay used comes from three sources. Originally the estuarine muds were used almost exclusively. These are still largely employed at Kent Works, being brought by barge from the lower reaches of the Thames. The disadvantages of this clay are the transport and handling its use entails and its bulky nature due to its large water content.

The outlier of London Clay at Swanscombe offers a good source, since here is a suitable material in a compact form. This supply, however, is rapidly diminishing, and a third source is being found in the marshes themselves. The inner margins of the saltings are being extensively dug and will probably constitute the most important future source. These marsh alluviums were not available until the introduction of rotary kilns, since the old bottle kilns would not burn up the peaty matter they contained. Rotary kilns, however, dispose of this, and the clay is more suitable than river mud, being both more solid and more readily available.

Johnson's and White's have slightly inland locations adjoining the North Kent branch of the Southern Railway. Both have the advantages of a solid chalk foundation and are connected up by tramway to riverside wharfs. At White's jetty there is a water depth of 16 ft. L.W.S.T. and can thus accommodate small steamers. Johnson's wharf has a smaller depth of water and is used mainly by river craft.

Bevan's works, existing in 1850, was completely rebuilt in 1924. A detailed examination of its site shows the underlying locational advantages which have caused this works, one of the oldest, to be at present the most modern and the biggest producer.

The southward swing of the river down Northfleet Hope causes a scouring of the S. bank and gives exceptionally deep

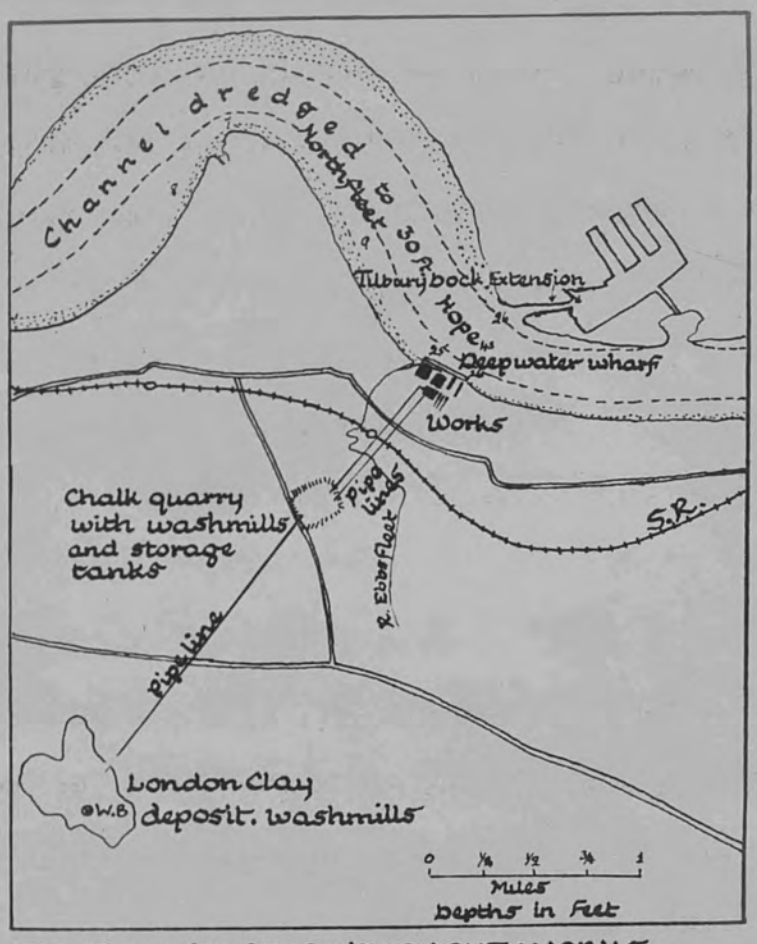


DIAGRAM OF BEVAN'S CEMENT WORKS

Fig. 51.

Note. Immediate site of works located by transport considerations not by the actual presence of raw materials.

water at the inmost point of the curve (see Fig.51). The deposition of alluvium is prevented and at this point the chalk extends down to the river, giving the best foundation conditions. To this double advantage to the site of Bevan's is added a third. Immediately opposite the new W. entrance lock to Tilbury Docks has been constructed, thus giving these works the most direct and nearest connection with Tilbury of any cement works.

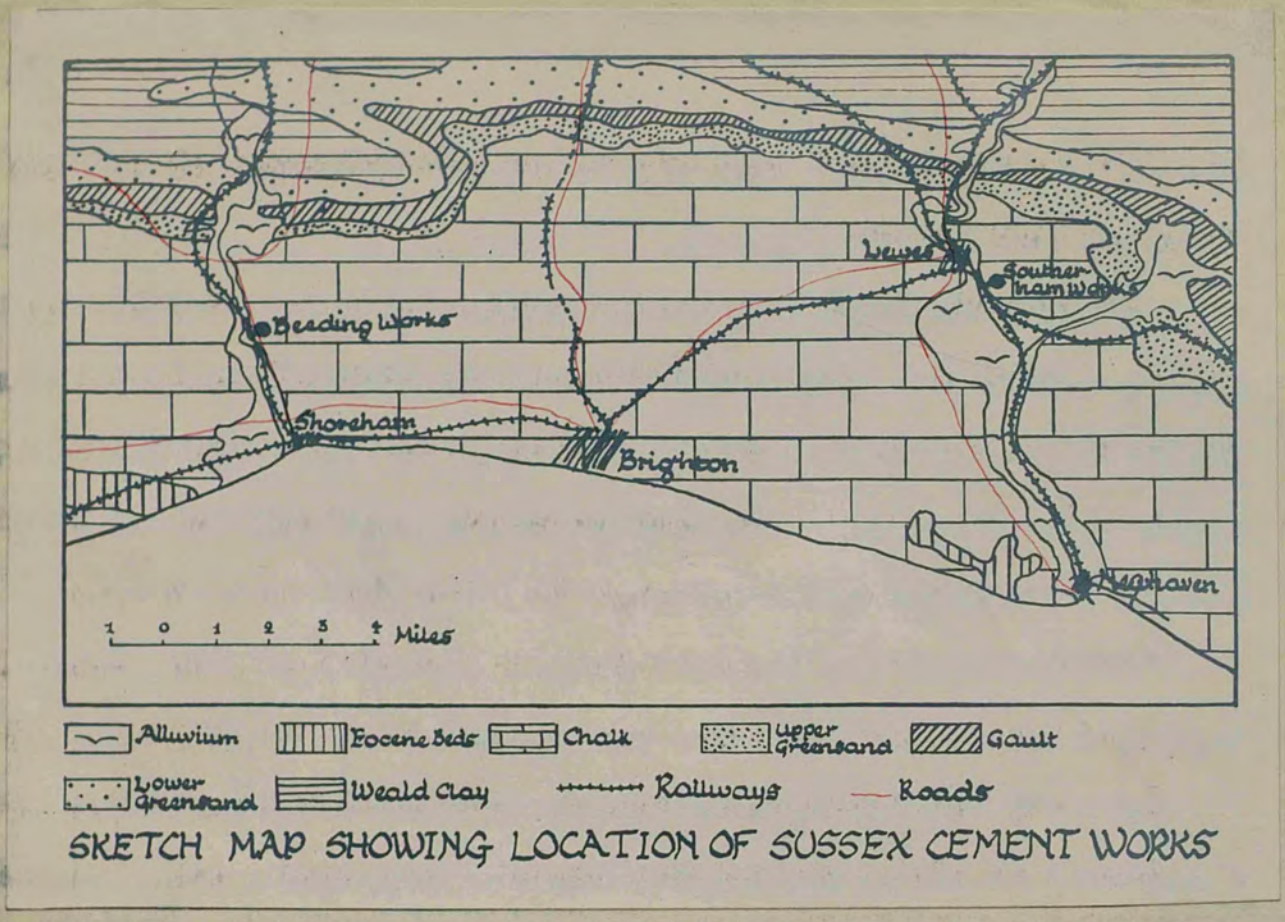
The raw materials used are the adjacent chalk and the London Clay outlier at Swanscombe Hill, about 2 miles distant. This clay is dug and tipped straight into wash-mills, mixed with water, and the resulting "slurry" pumped to storage tanks at the main wash-mill situated in the chalk quarry about 1 mile from the works (see Fig.51). Here it is mixed with the required amount of chalk (the usual proportions being three parts of chalk to one of clay) and the mixture is then pumped to storage tanks at the works where it is calcined, ground and stored. The cement handling and packing plant adjoins the wharves. The depth of water alongside the jetty is 46 ft. H.W.O.S.T. and 26 ft. L.W.O.S.T. and steamers up to 15,000 tons can be berthed at all states of the tide. The jetty stands away from the packing plant, thus allowing for inside accommodation for smaller craft. Slings of cement are loaded by crane straight from the packing plant to the steamer hold and up to 12,000 tons of cement can be despatched per week.

Gypsum, which is used for slowing the set of cement and is imported mainly from France, is imported at the western end and coal at the eastern. Coal is only used for firing the kilns, and is all sea-borne. Power is obtained in bulk from the main generating station at Barking of the SE. electric grid system (see Fig.32) - an interesting example of trends in modern industrial development.

Bevan's has the biggest output capacity of any works in Europe - up to 500,000 tons per annum.

Kent Works illustrate the importance of a riverside location, since to obtain it, the factory was built on more than 6,000 piles varying in length from 35-80 ft. on the marshes to the W. of Greenhithe. River conditions here do not, however, allow for such large scale or rapid despatch of cement as at Bevan's. The jetty has 8 ft. of water L.W.O.S.T. and is sufficiently long to allow two steamers of 1600 tons to load simultaneously. These works generate their own power and also supply Johnson's which adjoin and coal for this purpose, and for firing the kilns is all imported at the jetty. The output capacity is about 200,000 tons per annum.

The wave of economy of 1931-33 has resulted in a curtailment of public expenditure and a consequent cessation of public utility constructional undertakings. This has caused a considerable fall in the home market demands for cement and as a result the Kent Works are temporarily closed - production for



SKETCH MAP SHOWING LOCATION OF SUSSEX CEMENT WORKS

Fig.52.

Note the importance of transport factor in the localisation of works.

the London and export markets being concentrated at the other three Thames works.

Holborough Works, the only producing unit of the many Medway factories, Beeding Works on the Adur above Shoreham, and Southampton Works on the Ouse below Lewes, show many similarities of site, production and markets. All have sites near the beginning of the river gaps through the chalk scarps. Holborough and Southerham quarry the Lower Chalk and Beeding the Upper and Middle Chalk and all get their supplies of clay mainly from the underlying Gault. The rivers were originally utilised for distributing the cement, but each Works now supplies a local market and is aided by the concentration of road and rail routes through the chalk gaps. At Beeding the river is used for bringing the Gault a few miles down stream.

Near Holborough the base of the Lower Chalk is heavily mixed with clay and the resultant chalk marl provides a natural cement. Its use was at one time extensive, as the very large quarries below Bluebell Hill testify and a certain amount of it is still used at Holborough. The marl is, however, not uniform in composition and modern demands for an exactly proportioned cement make it simpler to use chalk and gault whose proportions can be strictly controlled.

Precise figures of output for the cement industry of S.E. England are not available but the amount of chalk quarried

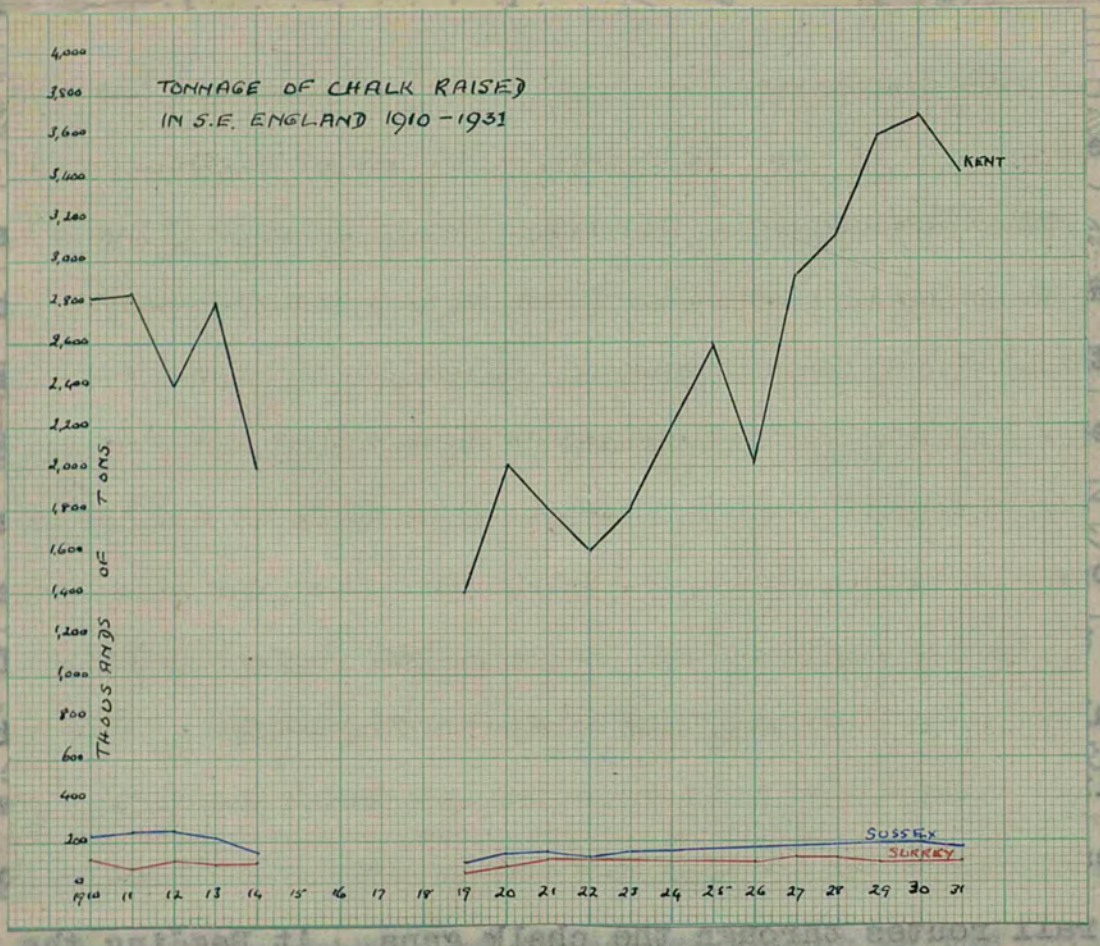


Fig.53.

Note (a) The predominance of Kent as a source of chalk.
(b) The big increase in Kent Production since the War.
(c) The small but steady outputs of Sussex and Surrey.

gives some indication of the growth of the industry and of the position of the area with regard to other regions. In Kent the chalk quarried has increased from between 2 and 3 million tons to between 3 and 4 million tons over the period 1910-1931, and the amount has fluctuated considerably (see Fig.53). In Surrey and Sussex, on the other hand output is low and has remained steady. A certain proportion of this chalk, and in Surrey the whole of it, is burnt for lime, or made into whiting. Surrey had a small cement works at Beddington but this is now used only as a storage and distributing centre. The "greystone" (Lower Chalk) is quarried and burnt for lime in the neighbourhood of Dorking and Oxted. The steadiness of output in Sussex and Surrey is associated with the fact that in both areas only local demands are supplied, and where the output of lime is concerned, a rise in demands due to increased building activities has been balanced by the diminishing use of lime for agricultural purposes. In Kent, on the other hand, the very big increase of production is associated with the growing use of concrete and the fluctuations with the fact that here the industry reacts to world market conditions which in this commodity fluctuate considerably (see Table XII. Export of Cement from the Port of London). The Kent output forms about 60% of the total output of the U.K. (see Fig.54), thus indicating the predominant position of the region in cement production.

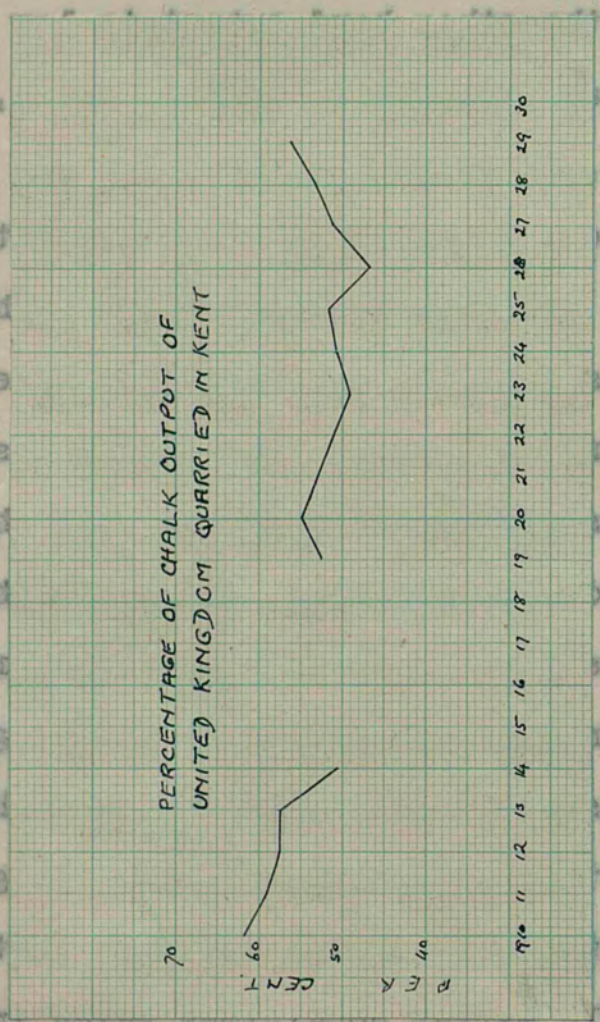

PERCENTAGE OF CHALK OUTPUT OF
UNITED KINGDOM QUARRIED IN KENT
PER CENT.
70
60
50
40
1910 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

Fig.54.

Labour.

The number of workers to which the cement industry gives employment has decreased very greatly since 1911. It is impossible to arrive at strictly comparable figures from the Census material available over the whole period 1911-1931, but between 1911 and 1921 there was a decrease of about 33% in the number of persons returned as occupied as cement makers and between 1921 and 1931, a decrease of about 58% in the numbers employed in the industry (see Table X).

A very large proportion of the labour is unskilled, and the omission of unskilled labour from the various occupational groups in the 1931 Census nullifies any attempt to show the present distribution of workers. There is, of course, almost complete concentration into the Thameside area. The long line of works bordering the Medway from its mouth to Aylesford are, with one exception, closed, and there is a general air of desolation over this part of the valley relieved only where the paper mills at Aylesford and Snodland show that the industry of the valley is not dead. The social problems, in and around Rochester, created by this unemployment of low grade labour are acute.

The decrease in employment, attendant on the rationalisation and concentration of the industry has been accompanied by very great increases in output per capita. The Board of Trade census of production shows that in the six years between

1924 and 1930, the average output of a cement worker in Great Britain increased from 257 to 410 tons and in Kent where large scale production has been proceeded with to a greater extent than elsewhere, the increase is probably greater.

Any increase in demands for cement would, of course, mean a rapid increase in employment but reuse of the Medway area is secondary to complete use of the Thameside works and the distance between the two areas, in conjunction with the mainly unskilled and therefore plentiful type of the labour precludes any large employment of Medway workers in the Thames district.

Markets and transport, as already indicated, are very intimately connected.

Holborough, Beeding and Southerham supply a local market and demands, though small, are steady. Delivery is almost entirely by lorry, the advantages of directness and flexibility being as effective in this type of trade as in the paper industry.

Table XII shows the export of cement from Shoreham and Rochester for the years 1911-1930. No export of cement appears in the Trade returns of Newhaven. There may possibly have been some coastwise trade at this port, of which figures are not available, but it is improbable that there is any to-day. At Shoreham the figures all relate to coastwise trade and their cessation shows the transference from this type of

carriage to road and rail transport. The Rochester figures relate to foreign trade. They show considerable fluctuation and were later figures available, they would show a drop to a negligible figure since 1930[1]. In 1931 a group of Medway firms was acquired by the A.P.C.M. and all were closed except the Holborough works from which the A.P.C.M. does no export trade. Coastwise trade, never large, has also practically ceased[2].

The main market for the Thames works is, of course, London. Coastwise provincial trade is considerable while the export trade forms less than 20% of the whole. The U.S.A was originally the biggest customer but at the beginning of the century cement manufacture in that country was rapidly developed and now she supplies her own demands. The bulk of the export now goes to the Crown Colonies and to Argentina which is one of the few countries with a poor supply of limestone. The export (see Table XII) which is almost entirely of Kentish origin, shows, on the whole, an increase proportionate to increase in production, a result due to the continual improvement and concentration of marketing and transport arrangements, whereby markets are supplied from the most conveniently situated works. Export trade is handled at Bevan's (transport facilities here have already been discussed).

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(1) On the authority of Port of Rochester officials.
(2) Figures for coastwise trade from Rochester are not available.

TABLE XII.

Exports of Cement from London, Rochester and Shoreham.

Year	London	Rochester	Shoreham.
1910	707,281 tons	12,489 tons	
1911	683,364	14,610	2,341 tons
1912	604,153	25,564	4,274
1913	709,079	18,493	15,290
1914	566,516	10,418	11,169
1915	380,983	18,512	
1916	366,557	11,243	
1917	323,012	2,178	
1918	181,694	2,098	
1919	339,689	22,640	
1920	550,885	36,091	
1921	265,388	13,603	
1922	347,364	5,318	
1923	469,426	10,492	
1924	576,141	12,740	
1925	589,897	20,369	
1926	441,971	20,255	
1927	609,325		
1928	732,651		
1929	902,287		
1930	866,925		

London and Rochester figures from the Annual Statement of Trade of U.K. Shoreham from Shoreham Harbour authorities.

Coastwise trade is handled by any of the Thames Works, according to the size of the steamer loading. The London market is supplied mainly from Johnson's, White's and Kent Works. Small consignments go by rail, or, more often, by road, but the bulk is taken up the river in lighters. The barge trade, so long associated with cement transport is dying. Its slowness was at one time compensated by its cheapness, but increased wage-rates now make it too expensive to be profitable. Motor barges have made their appearance but do not offer as cheap transport as a tug with a fleet of lighters, which is equally fast. There is a steady supply of small packets of cement to the docks for further export which is chiefly maintained because a small amount of cement among a general cargo is effective in "trimming" a vessel.

The importance of water as a transport medium is even greater in the cement industry than in the paper, and the emphasis rests on the outgoing product instead of on the incoming raw materials. The general tendency for the regular liner to replace the tramp-steamer places more and more importance on the deep-water Thameside-wharves, where liners can stop and take on a parcel either going to or from the Docks. Coastwise traffic also naturally gravitates to these deep-water wharves as the saving in lightening means a saving in time for the ship and expense for the manufacturer.

Any consideration of the cement industry as an expanding market for Kent coal again, as in the case of the paper industry, involves the question of freights. Its suitability for the firing of rotary kilns has already been discussed (see Chap. II.) and it is wholly used where it does not come into competition with sea-borne coal, i.e., in the Medway valley. This is at present a contracting market and though increase in cement demands would ultimately cause the reopening of some of the Medway works, this naturally would not come about until all the Thames works were working to capacity. A further competitor, and one that will not be influenced adversely by any rise in freights, is the electricity supplied from the main grid system. This reliance of large-scale industry on public sources of power will udnoubtedly extend and again places the emphasis on the London area as the natural market for the Kent coalfield.

To-day the Thames cement industry consumes about 500,000 tons of coal per annum, a third of the present Kent coal production, and of this, roughly a quarter is used for power and the remainder for process work. There is therefore a considerable market here for coal as a raw material and for which Kent coal is unquestionably suitable, but for which at present, Kent costs of production and transport are too heavy.

Since we are, presumably, only at the beginning of the

"concrete age" it is reasonable to suppose that the home market for cement will be an expanding one and that expansion will take effect in the most favoured region for its production, i.e. Thameside.

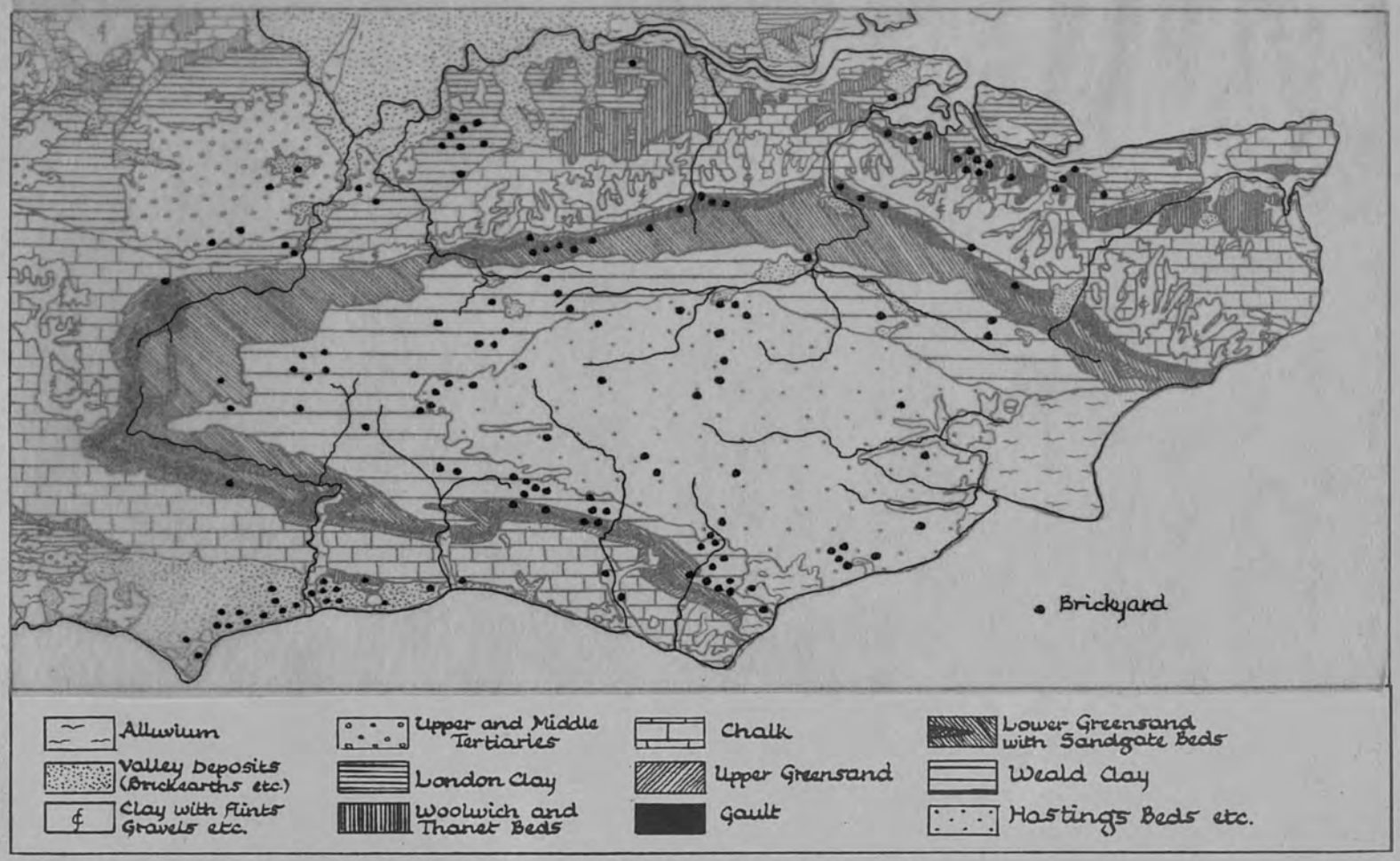
It is convenient at this point to include the sand and ballast industry which may be considered as an adjunct of the cement industry since it supplies the necessary aggregate for concrete manufacture.

Sands and gravels are, of course, dug throughout the region wherever suitable deposits occur, mainly from river gravels. A great number of widely distributed small pits supply local demands, but there are two areas where workings are extensive and which supply more than local needs. Near Teddington lock the Flood Plain gravels of the Thames are dug by the Ham River Grit Co., at Stone Court, S. of Greenhithe, the Boyn Hill gravels are dug by the A.P.C.M. The workings of the Ham River Grit Co. adjoin the Thames and a lock provides entrance from the river to flooded former workings along which wharves have been built. Much of the ballast is transported by barge, but there is also a big lorry traffic. The Stone Court workings lie about a mile from the river and as a result emphasis is placed rather on road than on barge transport.

These two sources are the biggest suppliers to the London market.

The Brick, Tile and Pottery Industry.

Brick and Tile manufacture has always been an important industry in the SE. counties, both on account of the great abundance and wide distribution of suitable brick earths and because of the comparative absence of good building stone. On the chalk areas flints were used to a limited extent for building purposes, both in a rough state and squared. At Lewes there are many beautiful examples of dressed flints used in domestic architecture and at Trottiscliffe church near Wrotham on the N. Downs, there is a wall of squared flints so truly split that the perfect halves of divided fossils may be observed. The art of squaring flints has disappeared and the process was always very slow. The Weald Clay contains layers of Paludina limestone which was once quarried extensively. It was known as "Sussex Marble" in Sussex and "Bethersden Marble" in Kent, and was only suitable for interior work. It is common in churches throughout the Wealden area, and was used for the altar stairs of Canterbury Cathedral, but is now never quarried. The sandstones of the area have yielded various types of building stones. The Weald Clay, a very variable deposit, contains a brown calcareous laminated sandstone in the neighbourhood of Horsham which splits into slabs suitable for paving and roofing. Examples of its use are common in the Horsham district but its great weight makes it unsuitable for most modern architecture and it is no longer worked. The Hastings Beds



GEOLOGICAL MAP OF SOUTH EAST ENGLAND

Fig.55.

Note (1) Very widespread occurrence of Brickyards.

(2) Main concentration on to the Brick Earths and the various clay series.

contain various sandstones which have been worked from time to time but the only building stones quarried to-day are worked from the Lower Greensand. The Hythe Beds yield the Kentish Ragstone, by far the most important building stone, both past and present, but one that has been little used for domestic architecture, since it is difficult to work and has other properties which make it not entirely suitable. There are several quarries in the neighbourhood of Maidstone and scattered along the Greensand outcrop, but the ragstone is now used more for roadstone than for building. In the Godalming district, the "Bargate Stone" is still quarried. This is a light brown calcareous sandstone which can be fairly easily extracted in blocks. It has a pleasing appearance but is not very durable and its use is very limited.

The whole area is primarily a brick country. In the Directory of 1930 there were 156 brickyards listed in Kent, Surrey and Sussex and the complete number is probably much larger since the area is characterised by the smallness and frequency of its yards. This is due to the fact that every geological formation yields, at certain points, some form of brick-earth. Even on the chalk areas, the extensive superficial deposits yield suitable materials.

An attempt has been made to show the distribution of the brickyards on the overlay to the geological map (Fig.55). It is impossible without an extensive survey, always to locate

each brickyard accurately and the generalised nature of the geological map does not always indicate the nature of the deposit worked. Certain factors of importance, however, emerge. First the generally widespread occurrence of the yards and second the concentration at certain points notably in Sussex, the coastal Tertiaries and superficial deposits of the Selsey-Bognor region and the Weald Clay area stretching from Pevensey to the Adur Valley; in Surrey, the London clay of the Esher, Claygate, Ewell district; in Kent the Tertiaries and Brick Earth of the coastal region round Sittingbourne. The Gault is marked by yards along its entire outcrop from Folkestone to Dorking.

Although this distribution takes no account of the size of the yards, and therefore, in some instances the importance of an area is more apparent than real, yet in general these areas are ones of major production.

Apart from the true Brick Earths of N. Kent and SW. Sussex, the clays on the whole provide the more important brick and tile materials. Of the total 156 yards shown, 36 are on Weald Clay, 18 on Wadhurst Clay and 14 on London Clay. The sandstones of the region, however, contain clayey deposits at certain horizons and these formations are therefore worked in certain localities.

The Fairlight Clays[1], the lowest formation of the Hastings

(1) The descriptions of the brick soils are based on the various Memoirs of the Geological Survey on the area.

Beds, are a complex series of grey and variegated clays, dark shales, silts and yellowish sandstones. The formation is only relatively clayey and its distribution is limited to a small area to the E. of Hastings. It was formerly extensively dug for bricks but is now little used.

The Ashdown Sands contain a good deal of silty laminated clay and in certain areas deposits of weathered clayey loam are dug for bricks. There are yards in the Ashdown Sands near Battle, Crowborough, Warbleton, Forest Row, etc., but they are small and as a whole the formation has little importance.

The Wadhurst Clays which overlie the Ashdown Sands, and outcrop extensively, are much worked in the neighbourhood of Hastings and Tunbridge Wells. They consist in the main of grey and bluish clays and marl with subordinate beds of silt, loams and sands and are frequently worked in conjunction with the overlying Tunbridge Wells sand, and their variety allows for great variety of production. At Lansford Brickworks near St Leonards, the various clays, silts, and loams of these two series are utilised "in the manufacture of specialities such as fire-brick, blue-brick, paving and ridge tiles and terra-cotta ware"[1]. The formation contains much iron and is only useful for common bricks. No very large brickworks are situated on it.

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(1) Memoirs Geol. Soc. "Geology of Hastings District 1928."

In the East Grinstead district, clayey beds of the Tunbridge Wells Sands become very prominent, and clays occur with great frequency throughout the series. In the Horsham region, at Pembury, at East Grinstead and at Hayward's Heath there are brickyards on this formation, often in conjunction with Wadhurst Clays.

The mass of the Weald Clay is formed of a stiff bluish or yellowish clay. Sometimes the clays are reddish and contain nodules and granular concretions of red brown iron ore. Partings of fine silty sandstones and beds of shelly limestone occur in certain localities and sandy beds are general throughout. The pure clays are valuable for tiles and where the clays are sandy good brick earths result.

Important brickyards work the Weald Clay at Pluckley in Kent, at Burgess Hill in Sussex and in the Cranleigh-Capel district of Surrey, while smaller brick works and potteries are spread generally over the whole outcrop.

The Atherfield Clay, the lowest formation of the Lower Greensand, crops out intermittently at the base of the Lower Greensand escarpment and floors certain of the river valleys in that formation. It consists of blue, red-brown or yellow clays, often sandy, and often containing nodules of clay ironstone. It has been worked fairly extensively in the past and it is still worked at Shalford near Guildford, at Redhill and in three or four other localities.

The rest of the Lower Greensand is only worked where it lies in conjunction with Atherfield Clay or with Weald Clay. At Berwick near Lewes it is used with Weald Clay and a bright red kiln brick of good quality is produced, but in general it is the least useful formation for bricks in the area.

Gault is an important formation. The outcrop though narrow and hidden in places is almost everywhere available for brick making. It is more uniform in composition than most of the clays of the region and consists of a very stiff dark blue clay. It is used extensively for the manufacture of drain pipes and tiles and frequently contains sufficient sand in its lower horizons or chalk in its upper, to be readily worked for bricks. When used alone it makes reddish bricks owing to a percentage of iron in its composition (about 3%) but it is more often used mixed with chalk to produce whitish or 'malm' bricks. It is an easy formation for the brickmaker to use rather than a high-grade brick earth. Nodules of pyrites, marcasite and phosphate of lime are frequently present and have to be removed. The comparative absence of these in the Aylesford district (Medway valley) accounts in part for the big workings there. Brickyards and Pottery works are very common on this formation. More important ones are those at Aylesford, at Nackholt near Ashford, at Dunton Green, Kemsing and Otford in the Sevenoaks area.

The Chalk, as such, is useless for bricks, but it is extensively mixed with gault or Tertiary deposits and small brick-yards are located where patches of Brick Earth or Plateau Loam occur along its outcrop. There are several small fields of this nature in Thanet.

Valuable Brick Earths occur in all the Tertiary formations. The Thanet Sands are largely composed of quartzose sand with irregularly distributed layers of clay and loam. The loams and clays occur mostly in the lower horizons and are worked in E. Kent and at Sittingbourne. They are frequently used in conjunction with the true Pleistocene Brick Earths which overlie them.

The Woolwich and Reading beds consist of reddish mottled plastic clays, interspersed with sands and grey fossiliferous clay. The Reading beds give excellent tile and terra-cotta clays and are worked at Epsom, at Guildford, at Sittingbourne, Plumstead and at Clapham Common near Worthing. Both series give brick-deposits as well.

The London Clay consists of a stiff dark or bluish grey clay. By itself it is useful for tiles, drain pipes and pottery but it is too contractile to be of great value for bricks and needs to be mixed with at least a quarter its weight of sand. Where it is adjacent to deposits of Lower Eocene Beds, to Bagshot Beds, or to cappings of Brick Earth it is

extensively worked. The passage beds to the Bagshot Sands, at the top of the London Clay consist essentially of alternations of sand and clay and are known as Claygate Beds. They form excellent brick-loams and are well-developed in the Claygate-Esher district. They are extensively dug for bricks at Tolworth, Chessington, Worcester Park, etc.

The Bagshot Beds, themselves mostly fine light-coloured sands offer opportunities for brick making where laminated clay bands and sandy loams occur in their middle series (in the Bracklesham beds). They are worked at Knaphill near Woking, in the Chobham district and near Aldershot.

The Pleistocene deposits, the true Brick-Earths, form the most important brick-material. They occur either in the terraces which have been laid down by the rivers at various periods, or as valley deposits, formed by the descent of material from the sides of the valleys. In either case they are very variable and are largely characterised by the nature of their parent rock. In the Lower Thames valley the Brick-Earths were formed largely from the destruction of London Clay and Bagshot Sand and in part from other Eocene clays and sands, and it varies from a light sandy loam to a clay that is little else than reconstructed London Clay. Throughout N. and E. Kent the Brick-Earths vary greatly and in the Medway valley they are largely derived from Wealden rocks. There are important deposits round Hadlow and Tonbridge which form such

good hop soils that they are little dug for bricks.

The Brick-Earths of the Chichester-Worthing area differ slightly in origin. They are formed from the Coombe Rock[1] of the district, but their general character is very similar to that of the later Pleistocene Brick-Earths - very variable and in parts very chalky. They are extensively dug in the Selsey-Bognor district.

The various superficial deposits of the region give brick-earths of varying quality. The stiff, plastic Clay-with-Flints makes good bricks when freed from flints and mixed with earth. At Sandwich and in various other localities, alluviums are used. Although good bricks can be made from the superficial deposits, they tend not to be utilised where other loams or clays are available because of the many pebbles or flints they contain which necessitates considerable washing.

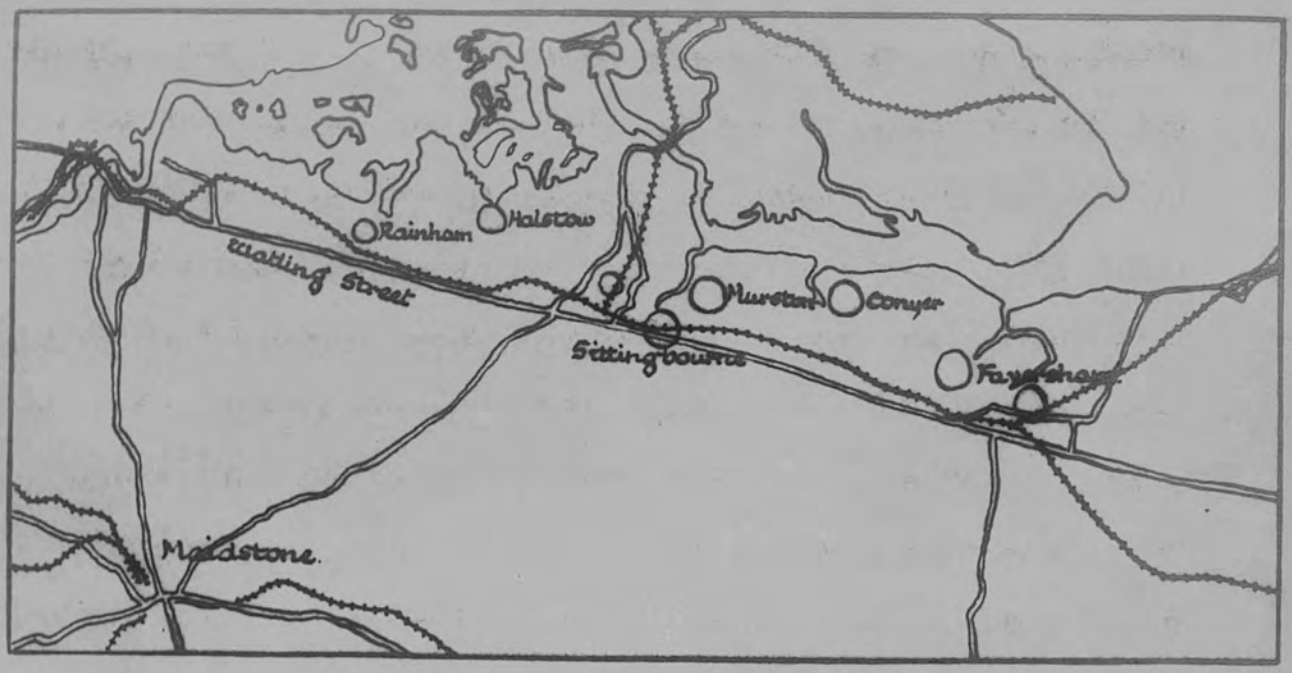
The abundance throughout the region of brick-making materials is thus clear and SE. England has always been the centre of the production of hand-moulded facing bricks, of good texture and varied colourings. Surface clays, Bagshot Beds and Reading Beds produce the best bricks of this type. The other distinctive production of the SE. is the "London Stock Brick", a hand moulded brick in which the clay is mixed with washed chalk and the red colour is changed to a yellow or brindled tone. The centre of this production is Sittingbourne.

(1) Coombe rock is the deposit of chalk-rubble and battered angular flints with clay and sand which was derived during the Ice Age from the Eocene and Cretaceous rocks by torrential rain action in summer on frozen rocks.

The old-fashioned clamp-burning is still largely used but has been superseded by kiln-burning in many of the big yards.

The characteristic of the industry is high quality of production and this it must of necessity maintain since it cannot compete with the Peterborough district in the production of cheap bricks. The qualities of the Oxford Clay make the production of cheap bricks very easy in this district and Peterborough in some years produces about one fifth of the total English production of about 5,000 million bricks. For the supply of external markets, therefore, the SE. district must rely on quality.

The brickyards are of two main types; those producing for a local, or not very extended market and those producing mainly for the London market. By far the larger number of yards belong to the first type and their prosperity has depended on the increasing urbanisation of the whole region. The expansion of London to the S. has resulted in big building developments, most of a domestic type for which the locally produced bricks and tiles are the natural media. Brick-yards of the Claygate area, and of the Plumstead, Erith region are closely connected with suburban development. In the S. Sussex region, the big development of brick-making is associated with the rapid expansion of the South Coast towns. The Brick Earths of the Worthing-Littlehampton district make good quality white bricks, but the typical warm red Sussex



BRICK-MAKING CENTRES OF THE NORTH KENT COAST

Fig.56.

Note (a) the Creek location of all the brick-yards.
(b) their favourable situation with regard to road and rail transport.

bricks come from the Weald Clay of the Ditchling, Keymer, and Burgess Hill district. Before the War Bricks entered into the coastwise trade of Shoreham, but none have been exported since 1913, and cheap foreign bricks are largely imported.

There are, however, certain yards where local markets are not, or were not originally the main consideration. Having regard for the widespread occurrence of the brick-earths the main determining factor in their location was the availability of good and cheap transport facilities. The more important of these yards form a succession bordering the creeks of the N.Kent coast, at Sittingbourne, Faversham and Conyer etc. (see Fig.56). The water plays a less important part than formerly in transport matters, but the trade of the yards was built up when cheap water transport gave an initial advantage. In this district the Valley Brick-Earths, Woolwich and Reading and Thanet Beds are worked, together with an admixture of the underlying chalk and a small amount of alluvium. The fortunate occurrence of the best brick materials on or near a coast full of creeks and inlets, gave the region great advantages, both for the importation of coke and breeze (for mixing with the clay and firing the bricks) and for the export of bricks for the London and coastal markets. The brick-yards cover extensive areas; the earths adjoining the creeks have been largely exhausted and the workings pushed inland. Tramways connect up the clamps and kilns with wharves on the creeks and the bigger yards have siding connection with the railway.

The main product, as already noted, is the London Stock Brick, a light coloured, high-grade, very resistant brick. In addition a certain number of red-facing bricks are made. These are kiln burnt and machine made, whereas the stock-bricks are still largely hand made.

The following table shows the present annual production of bricks in this neighbourhood. The figures are approximate.

TABLE XIII.

Output of Bricks in N. Kent.

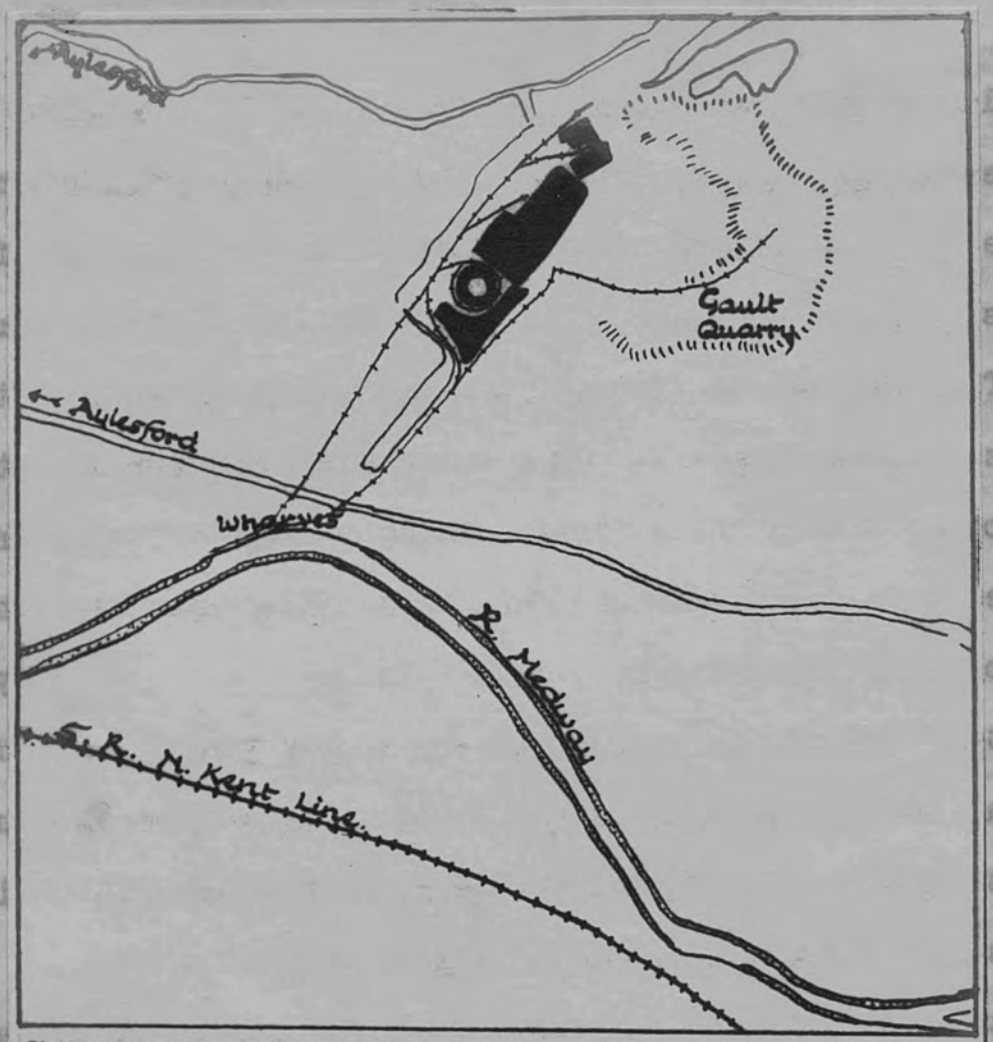
Area	Output in million bricks*
Sittingbourne and Murston	80
Halstow	14
Conyer	14
Rainham	14
Faversham	12
Total	134

The total output is lower by about 40% than the pre-war output and the decline is attributable in some measure to the exhaustion of the brick-earths in certain areas, but more especially to the competition of "flettons" (the Peterborough bricks) on the London market and whereas originally London

(*) This information was supplied by the brickmakers.

formed the main market for the whole output, now the districts furthest removed from London find their more important markets on the coast. Almost all the Faversham production of 12,000,000 bricks find a market in Thanet. This has been in part responsible for changes in transport. Before the war almost all the bricks were waterborne. Now only about 10% go by water. In the London area, the point of consumption is in general so far removed from the Thames, that barge transport is both lengthy and costly. The bulk of the bricks is now carried by road, whilst a small proportion goes by rail. Again the advantages of road transport are its flexibility and the opportunity it offers for quick delivery of small consignments. All the fields lie within two miles (and most are nearer) of Watling Street, the main London road. The fleets of barges which the industry still possesses are utilised for bringing round from the Thames mouth, London refuse and ashes which are used in making the stock bricks, and also a certain amount of coal for firing the kilns. It is generally, however, found more convenient to import the coal by rail for, by this method, the trucks can be run alongside the point of consumption. The industry offers but a small market for coal, and one for which the locally produced coal has apparently not been found suitable[1].

(1) The non-utilisation of Kent coal in S.E. industries is not always a sign of unsuitability. There has been considerable prejudice against it in this most conservative of regions and the advantages it offers in price have not always been sufficient to overcome this.



SKETCH MAP SHOWING THE SITE OF AYLESFORD POTTERIES

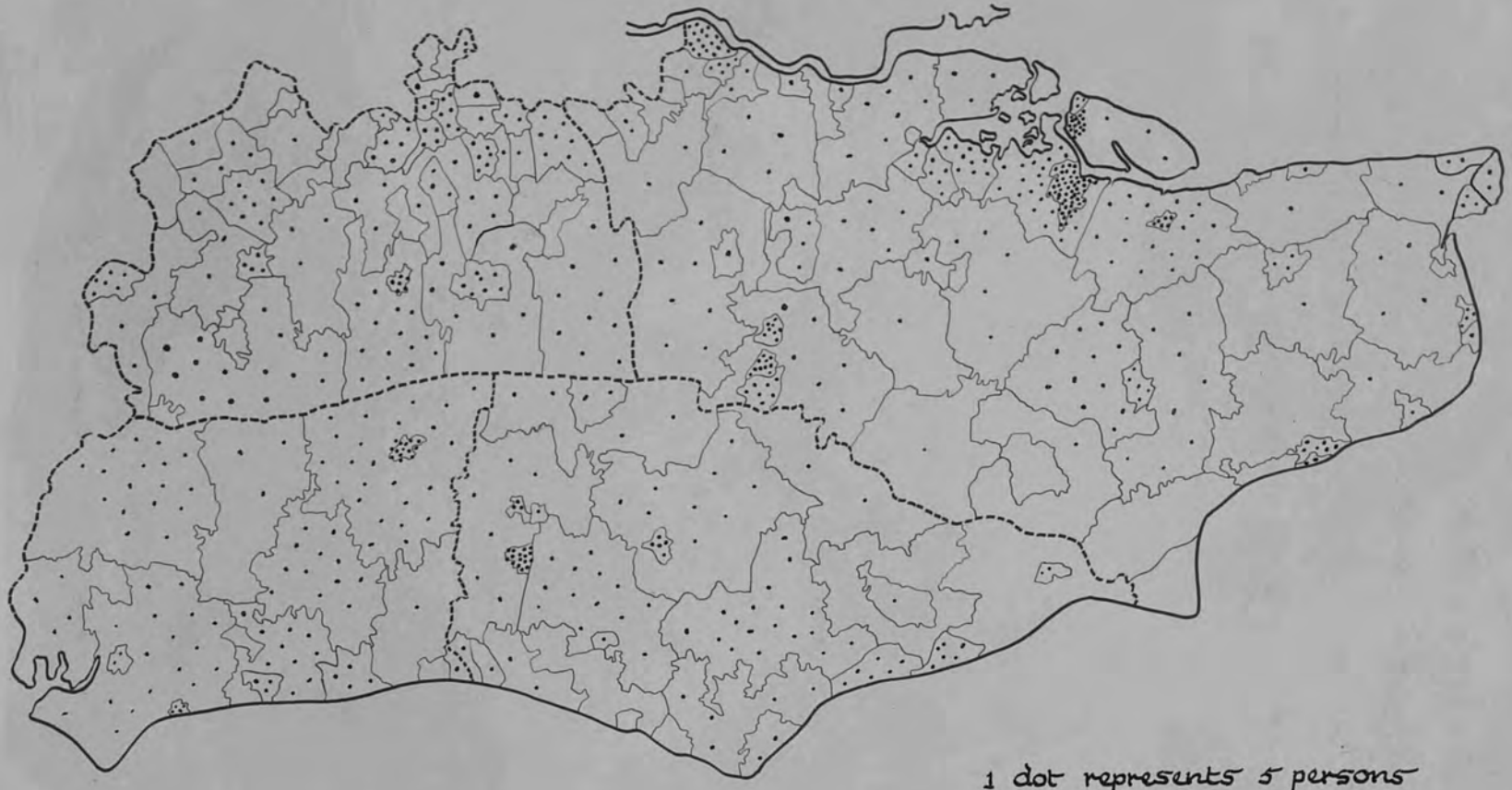
Fig.57.

Note the availability of both road and water transport for these potteries. Water transport is now entirely disused.

The Aylesford potteries illustrate in a similar way the change in transport methods. This pottery (Fig.57) works the Gault clay for the production of bricks of many different types of tile and drain-pipe etc. They are connected by tramway with wharves on the Medway and formerly most of their product was sent down the river to the Medway towns and to the Thames estuary. This river transport has entirely ceased, they have no ready connection with the railway and to-day the whole of their output goes by road.

The decline in output of the North Kent area is not reflected at the smaller yards which manufacture for local trade and in each county there has been an increase in the number of men employed in the industry since 1921. (Table X.) In Kent the increase amounts to about 45%, in Surrey to 53% and in Sussex to 53%. The larger increases thus occur in the two counties where brickmaking is more local in character. The distribution of brick and tile workers is shown in Fig.58. It illustrates the predominance of the Sittingbourne area and the importance of Erith, Tonbridge and Tunbridge Wells in Kent; of Horsham and Burgess Hill in Sussex and in Surrey of the NE. suburban region.

In conclusion the main features of the industry may be summarised as follows. A growing diffusion in production is illustrated by the shift of importance from major producing



DISTRIBUTION OF MAKERS OF BRICKS AND POTTERY 1931

Fig.58. Note the widespread distribution with the main emphasis on the Sittingbourne, Queenborough region.
(Prepared from Occupational Tables of 1931 Census.)

points to locally important areas, rather than by a direct increase in the number of yards[1].

The general high standard of production becomes increasingly more important as easy road transport encourages the competition of cheap grades from outside the area.

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(1) In this way a complete contrast is offered to the cement industry.

Chapter IV.

AGRICULTURAL INDUSTRY.

In common with the rest of England, the present condition, major problems and trends of agricultural industry in SE. England to-day are largely determined by economic problems external to the region and by non-agricultural internal development. Soil, topography, climate, those factors which make up the natural environment form often an increasingly less important part of the complex influences which determine land utilisation. Yet, by contrast, the strong competition, and difficult price conditions with which most branches of agriculture have to contend, throws into relief those very factors of natural environment.

Certain crops tend to concentrate more and more into those regions most suited, by superior physical and climatic conditions, to their production[1]; the control of other production seems to be almost wholly freed from these physical considerations[2].

Therefore to appreciate the existing condition of agricultural life in SE. England, a consideration of its natural

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(1) e.g. The hop industry.
(2) This is instanced in certain market gardening and dairying developments.

and economic background is essential. Many aspects of this background have already been discussed, others are so obvious and so well known as to scarcely need discussion, and it is only possible here to deal with those having a close connection with the subject.

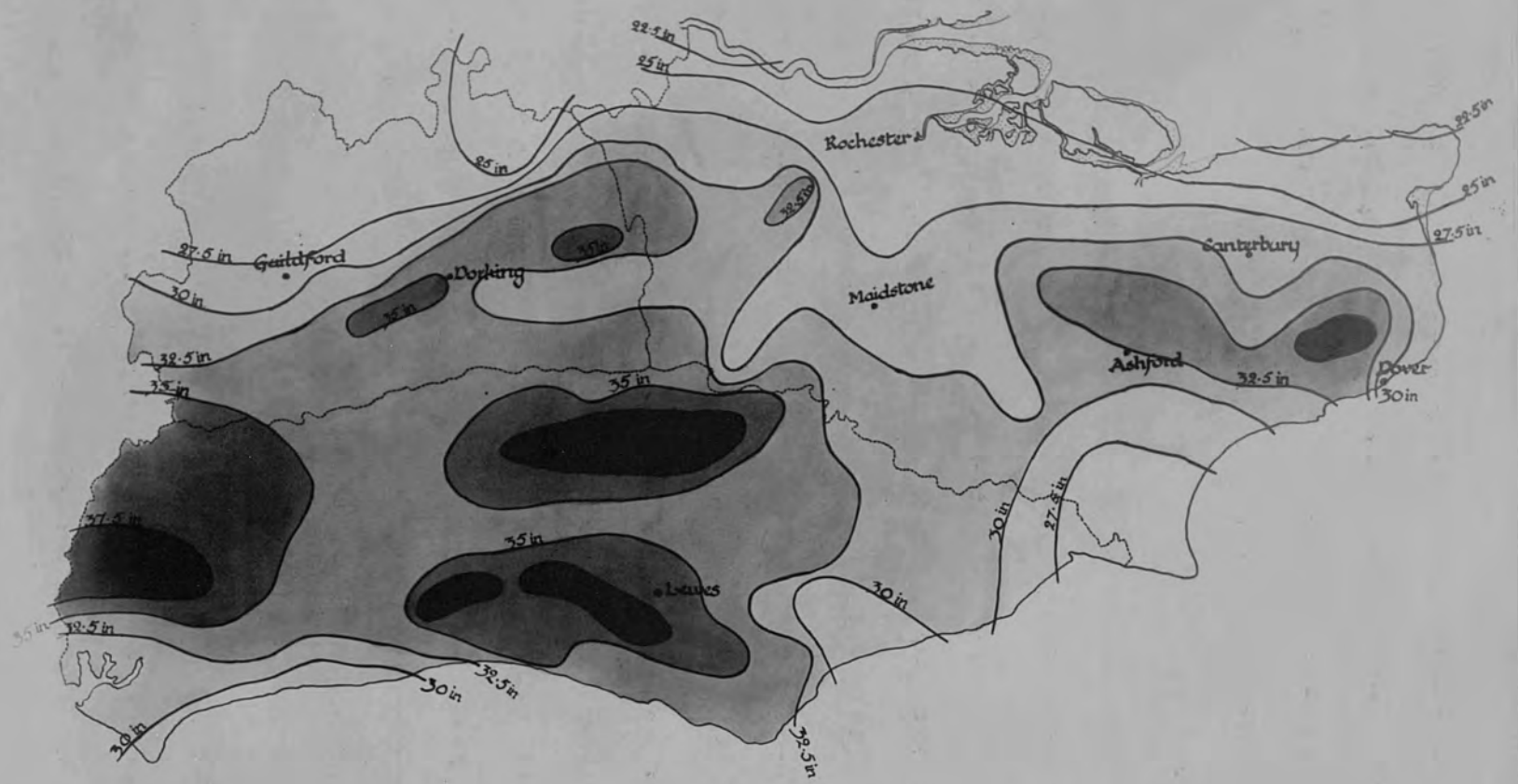


Fig.59. Note (a) Big variation in rainfall within the region.
(b) Orographical control of distribution.

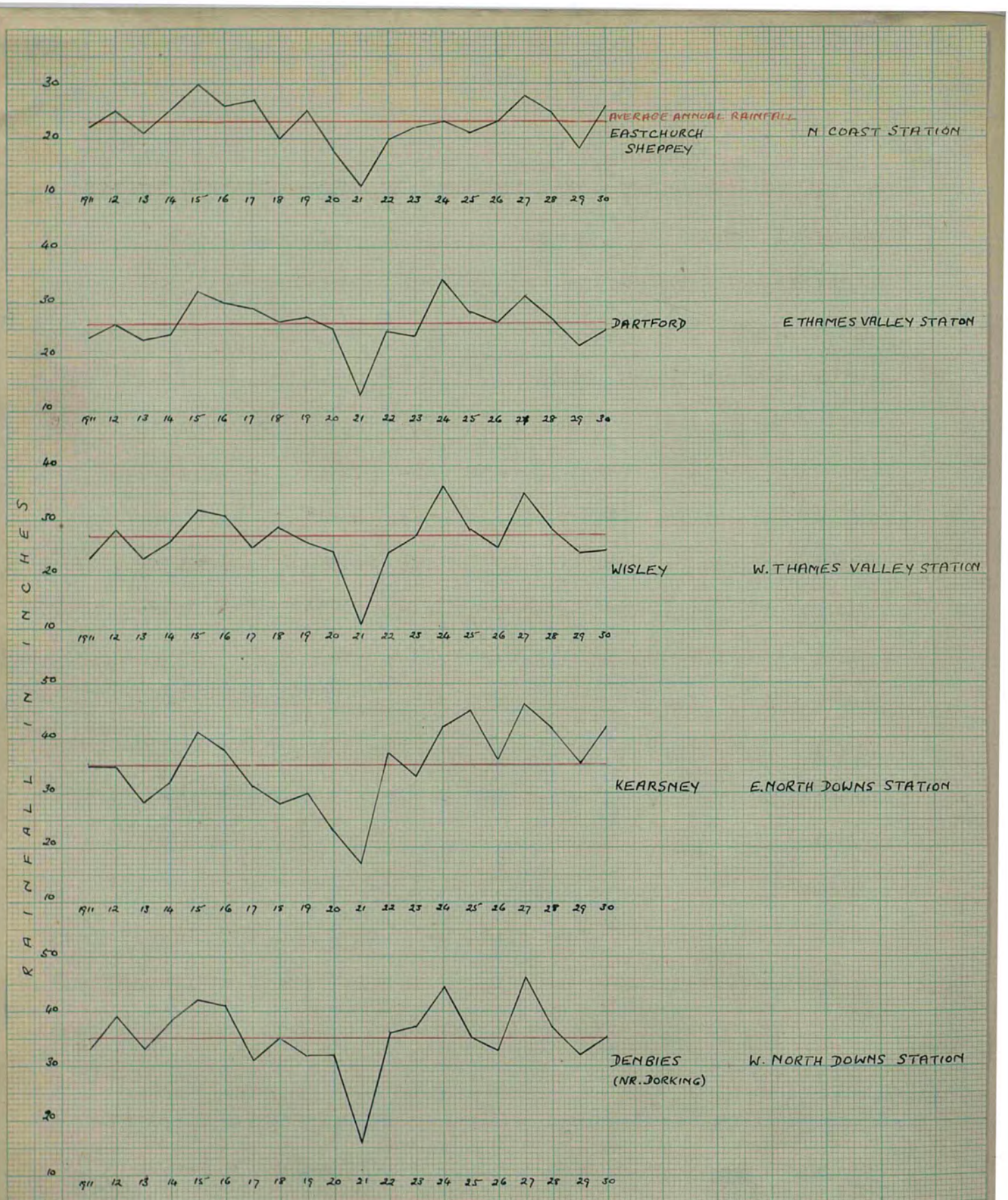
Climate.

The three SE. counties lie within that region of the British Isles having the highest pressure conditions throughout the year (an average of 29·75"), the greatest amount of sunshine, the lowest rainfall and the greatest seasonal variation in temperature.

Accurate and complete details of the climate of the region are difficult to obtain, since rainfall stations with a continuous record are not numerous, and are especially scarce on the higher parts of the region whilst temperature and sunshine figures are almost wholly confined to the coastal health resorts or to inland air stations. In the latter instance they cover only a recent period.

Maps and graphs have been prepared from data obtained from the records of the Meteorological Office for the period 1911-1930, and are as complete as possible. Where a full 20 year period has not been obtainable for any station the fact is indicated but this variation in the length of records prevents many of the station records from being strictly comparable.

The total rainfall is, on the whole, light, varying from over 37 inches on the higher lands of Sussex to below 22.5" on the extreme edge of the NE. coastal belt, and while the main control of distribution is orographical, accompanied by a general weakening from W. to E. correlated with the flow



GRAPHS SHOWING VARIATION IN ANNUAL RAINFALL AT SELECTED SE. STATIONS: 1911-1930

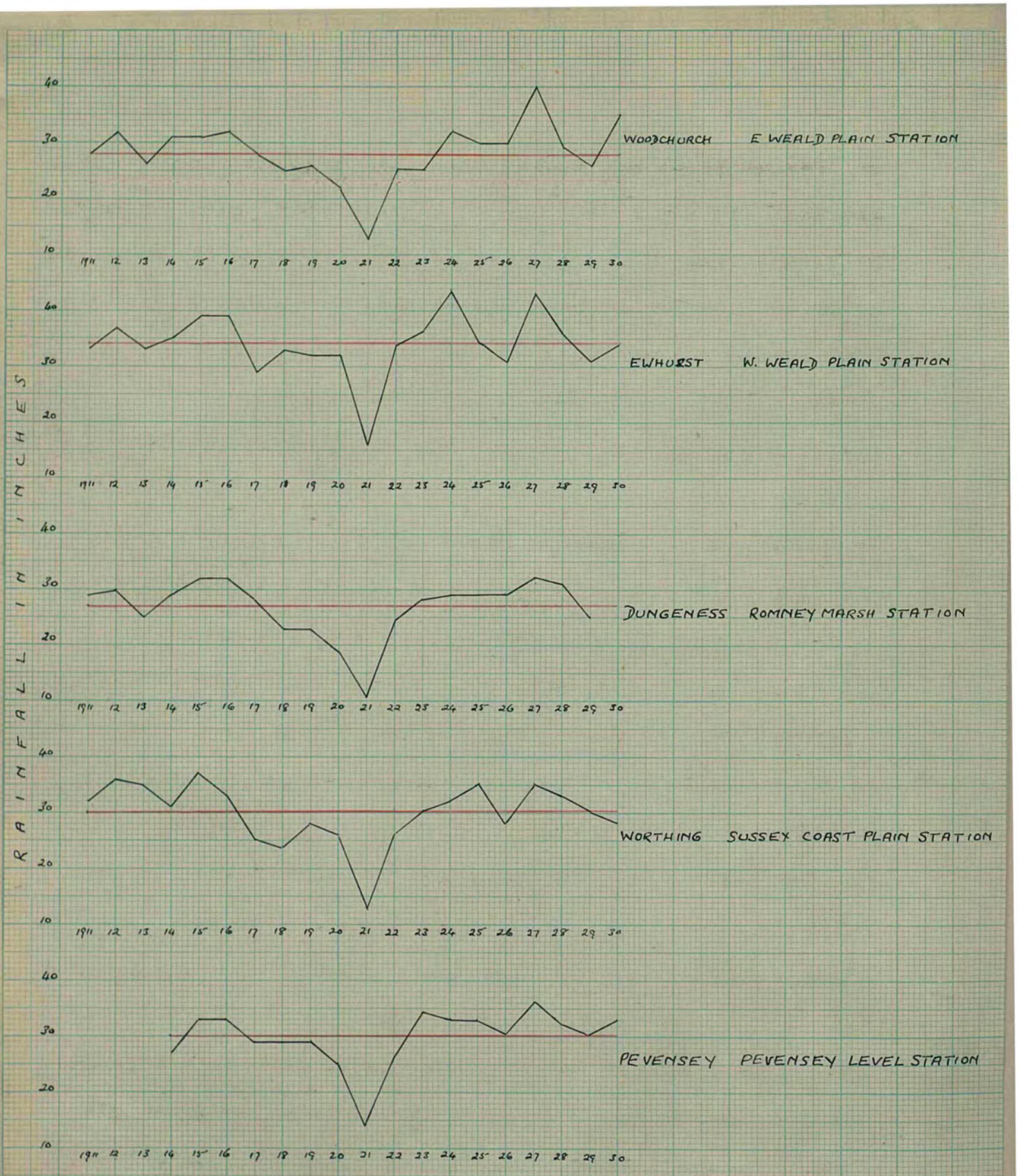
(FROM DATA SUPPLIED BY METEOROLOGICAL OFFICE)

Fig. 60.

of the SW. winds, the NE. littoral is also affected by the westward extension of Continental pressure conditions. This is especially marked in late winter and spring and tends to lessen winter rainfall and thus to accentuate the generally dry condition of the area.

The permeable rocks of the region, the Chalk, Greensand, and Tunbridge Wells and Ashdown Sands, forming as they do the highland areas, receive the largest amount of rain and act as great storage reservoirs and though in general they suffer from lack of surface water (especially the Chalk) and consequently often over-dry soil conditions, this condition is modified by their ability to break the summer showers which miss the lower lands. The productivity of the light permeable soils of the region is greatly affected by the height of the water table. For example, though the Greensand soils of Surrey are usually better in quality than the Bagshot Sands in the same county, yet the latter are often more cultivated because of superior water conditions, and, again, where the Greensand is underlain by the hard Bargate Stone in the neighbourhood of Godalming, the moisture supply is much improved and a region of intensive cultivation results. This question of the relationship of water table heights to land utilisation in the area has received as yet but little attention.

In the N. and E. rainfall tends to be very low, and here owing to the tendency to drying winds and long sunshine



VARIATION IN ANNUAL RAINFALL (CONTD.).

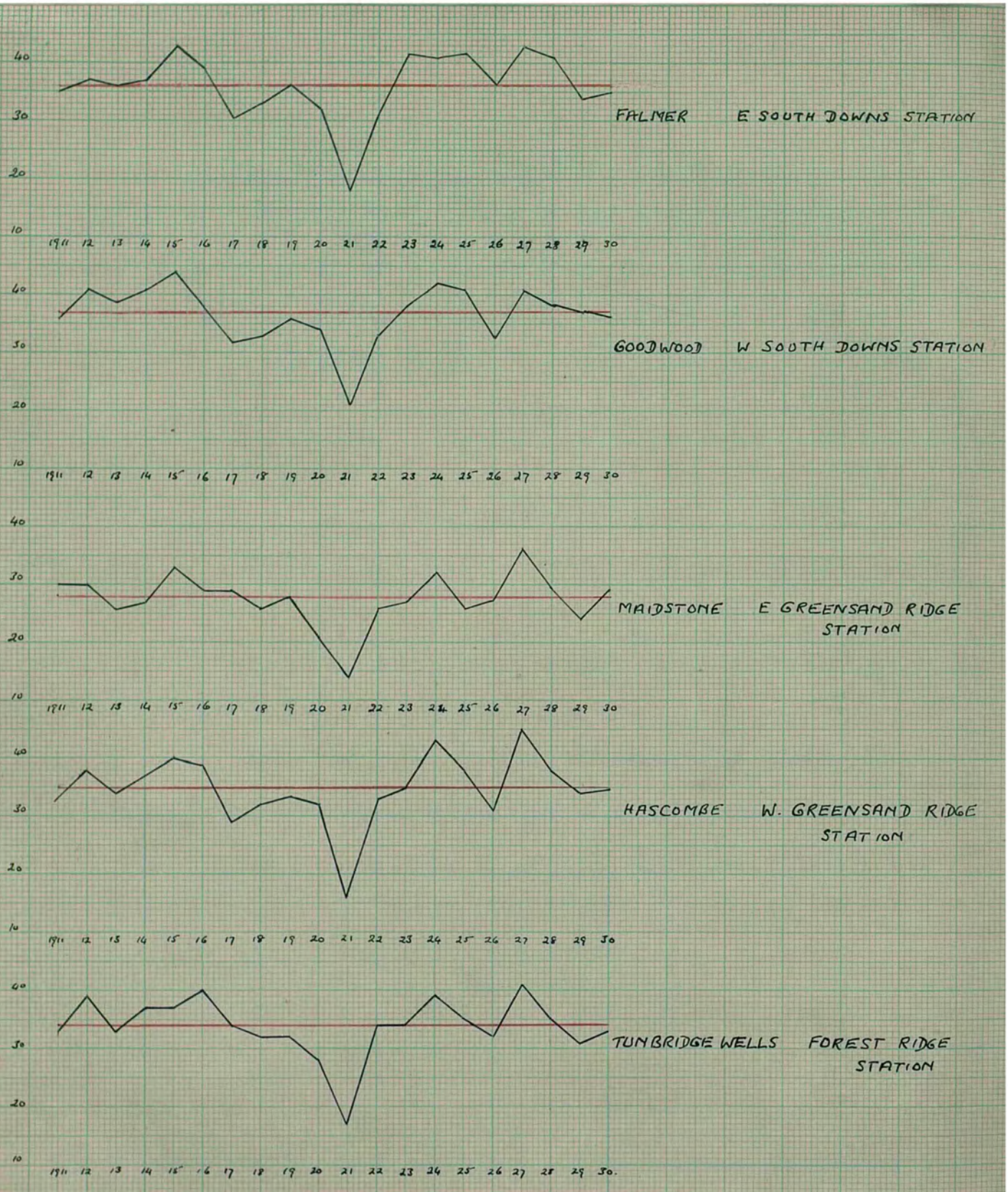
Fig.60 contd.

evaporation-rates are high. This high evaporation-rate is important for the production of high-quality, good-coloured fruit, and much of the success of fruit growing in the region is due to this factor, but the resultant low water supply for plant growth necessitates special methods of cultivation whereby a firmly compacted subsoil is obtained to lessen the loss of water by percolation. The deep, fine-working loams and fine sands of the region make a fine tilth possible and the retention of a maximum amount of the rainfall for plant use. The Sussex maritime strip of somewhat similar soil conditions shows no similar tendency to over-low rainfall.

With the possible exception of the NE. region, rainfall is everywhere adequate. Over-dry conditions on the highlands and over-wet in the vales are a result of soil conditions.

The variation in annual rainfall during the period 1911-1930 for certain selected stations is shown in Fig.60 and analysed in Table XIV. The stations have been selected as having a typical rainfall for their respective regions and the results show that rarely in more than a quarter of the years does rainfall depart from the average by more than 5 inches; that the chances of the rainfall being below or above the average are about equal; that valley stations show a lower number of years than upland stations when rainfall departed from the average by more than five inches and that regions of low rainfall fortunately show the greatest dependability.

Fig.60 contd.



VARIATION IN ANNUAL RAINFALL (CONTD.).

Fig.60 contd.

TABLE XIV.

The Departure of Annual Rainfall from the normal at Selected S.E. Stations, 1911-1930.

Station.	Maximum amt of Variation in Annual Rainfall during period 1911-1930.	No.of years during period 1911-1930 when annual rainfall varied from normal by more than 5"	No.of years when rainfall fell below average	No. of years when rainfall rose above average	Proportion of annual rainfall falling during April-September.
Eastchurch	17 ins	2	9	9	46
Dartford	21	3	9	8	46
Wisley	25	3	11	8	45
Kearsney	29	10	9	8	40
Denbies	30	5	8	9	42
Falmer	25	4	8	9	41
Goodwood	23	2	9	10	41
Maidstone	25	3	10	9	43
Hascombe	29	4	10	8	41
Tunbridge Wells	26	4	9	8	41
Woodchurch	27	3	8	10	47
Ewhurst	27	3	9	8	43
Dungeness*	21	2	7	12	38
Worthing	26	4	8	10	41
Pevensey*	22	2	6	8	41

*Dungeness Period 1911-1929. Pevensey 1916-1930.

This last factor is of the greatest importance to the arable farming region of the N.Kent coast. The only year of serious drought occurred in 1921, when conditions were very abnormal and this drought year makes the figures showing the maximum variation of rainfall for the period, unusually large. The biggest range in variation tends to occur in regions of heaviest rainfall. Kearsney, Denbies (near Dorking) and Hascombe, all upland stations, show the highest figure, while Eastchurch, Dartford, Dungeness and Pevensey show the lowest.

Fig.61 shows the monthly distribution of rainfall at selected stations. There are two maxima, winter and late summer, while June is everywhere the driest month.

The winter maximum is much heavier and more prolonged than the summer and is more pronounced in those regions of greatest total rainfall, i.e., areas of low rainfall have a proportionately greater amount available during the growing period. At Sheppey and Dartford 46% of the annual rainfall falls during the months April - September while on the North Downs and Greensand Ridge, the amount varies from 40-43%. The low-lying regions of Dungeness and Pevensey are exceptions to this general rule.

The high July - August rainfall, which, generally speaking, is the most serious defect of the English climate from an agricultural point of view, is, in this region, largely compensated by a high proportion of sunshine, especially

Fig.61.

marked in the coastal districts (see below). On the dip-slope of the North Downs and in general along the N. coast there is a marked tendency to a subsidiary rainfall peak in April and this strengthening of the rainfall during the period of maximum plant growth is particularly favourable.

To sum up, therefore, rainfall is for the most part sufficient and where it tends to be low its lowness is intensified by correspondingly higher evaporation rates. This disability, however, is largely compensated by soil conditions which check evaporation and by superior monthly distribution and annual dependability.

Temperature amounts show very much less variation from point to point (see Table XV). Summer maximum averages 60°F. and is slightly retarded in the coastal regions, and the minimum winter temperature of 40°F. shows a similar tendency. The annual range varies from 19·8° (Selsey) to 22° (Canterbury, Kew, etc.[1]) and is high compared with the range in other parts of the British Isles.

The analysis of temperature conditions is much restricted by lack of recording stations. In general there is no marked rise from the winter temperatures until April-May, while the autumn fall is, by contrast, slow and gradual. The late spring diminishes the danger to crops from frost, while autumn

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(1) N.B. Biggin Hill and Wye show a greater range but temperature observations at these stations only extend over a short period.

Table 15

Average Monthly Temperatures: 1911 - 1930 x

	J	F	M	A	M	J	J	A	S	O	N	D	Range
Coastal Stations													
a) N. Margate (20)	41.3	41.5	43.8	46.9	54.0	58.3	62.4	62.6	59.5	53.0	45.6	42.6	21.3
b) E. Dover (17)	40.54	40.63	42.96	46.43	53.63	57.21	61.04	61.31	58.36	48.93	45.13	42.43	20.8
Ramsgate (16)	40.13	40.32	42.62	46.14	53.13	57.27	61.11	61.57	58.39	52.06	44.41	41.44	21.5
c) S.E. & S. Folkestone (15)	40.57	41.74	44.31	47.25	53.77	57.97	62.31	61.79	58.85	53.16	45.37	42.5	21.8
Dungeness (18)	40.9	41.1	42.9	45.9	52.6	56.9	60.8	61.4	57.5	52.0	44.9	42.6	20.3
St. Leonards (17)	41.2	41.3	43.0	47.3	53.9	57.7	61.2	61.5	58.6	52.8	45.5	42.2	20.3
Eastbourne (20)	41.9	41.7	43.7	47.1	53.8	57.8	61.4	61.8	58.6	53.1	46.0	43.2	20.1
Brighton (20)	41.4	41.6	43.8	47.5	54.5	58.3	61.9	61.9	58.8	52.9	45.5	42.9	21.5
Worthing (16)	41.1	41.9	43.7	47.2	54.6	58.0	61.6	61.7	58.1	52.2	44.5	42.3	20.6
Bognor (16)	41.7	42.1	43.6	47.2	54.1	57.7	60.8	61.1	57.9	52.0	45.0	42.8	20.6
Selsey Bill (19)	42.0	42.0	43.9	47.2	54.0	58.1	61.7	61.8	58.6	52.8	45.6	42.9	19.8
Thames Valley Stations													
Addington (18)	39.3	39.4	42.0	45.6	53.3	57.1	60.5	59.9	56.4	50.5	42.2	39.8	21.2
Croydon (10)	41.4	40.7	43.6	46.8	54.2	58.1	62.8	61.3	57.8	51.6	43.4	40.7	22.1
Kew (20)	40.8	41.1	43.5	47.1	55.1	59.3	62.9	61.9	57.5	50.6	43.6	41.6	22.1
Wisley (20)	40.3	40.4	43.0	46.8	54.6	58.5	62.1	61.4	57.1	50.2	43.0	41.1	21.8
North Downs Stations.													
Biggin Hill (Hill Top) (10)	39.6	39.1	42.2	45.0	51.6	56.3	61.3	59.7	56.5	50.3	42.1	39.1	22.2
Canterbury (Valley) (15)	40.8	40.4	43.4	46.9	54.7	58.4	62.4	62.1	58.2	51.1	43.8	40.9	22.0
Wye (Valley) (6)	39.2	39.6	43.0	46.6	52.4	57.1	61.8	61.1	57.3	50.4	44.1	39.4	22.6

* N.B See note to Table XVI on overpage.

Table 14 (contd)

	J	F	M	A	M	J	J	A	S	O	N	D	Range
Greensand Ridge Stations													
East Malling (6)	39.6	39.7	43.2	46.6	52.2	57.9	61.7	60.2	56.3	49.0	42.6	39.7	22.1
Lympne (10)	40.0	39.6	42.5	45.5	51.8	55.9	60.6	59.7	56.9	51.2	43.1	39.7	20.9
Forest Ridge Stations													
Tunbridge Wells (19)	39.9	39.9	42.8	46.1	54.1	57.5	61.6	60.9	57.3	50.4	43.0	40.7	21.7
Ardingly (15)	39.0	38.7	42.1	45.4	53.9	57.2	60.7	59.9	56.6	49.9	42.1	39.0	22.0
Weald Plain Station													
Hellingly (7)	40.5	40.5	42.8	46.1	52.8	57.2	61.5	60.3	57.7	51.4	45.0	40.3	21.2

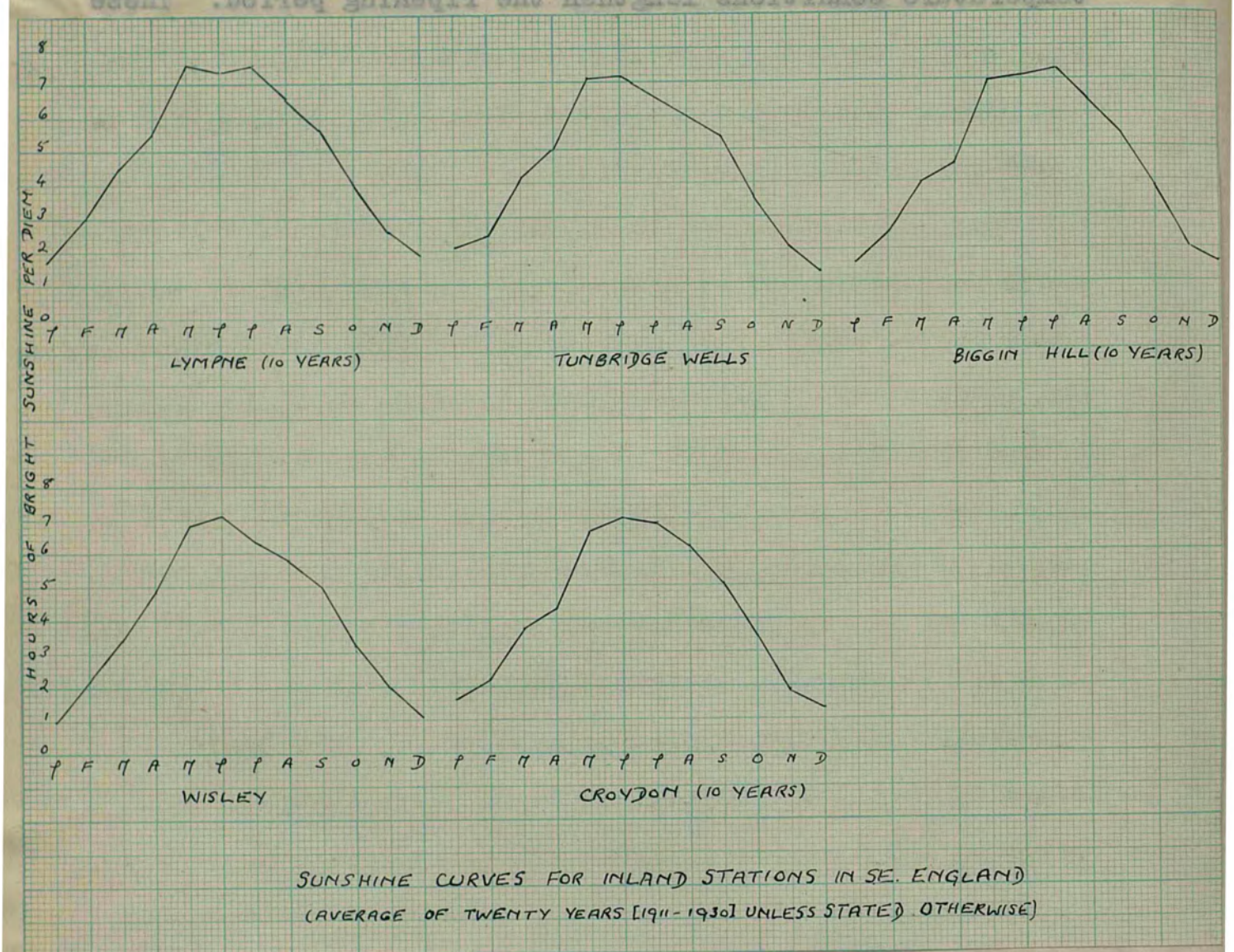
x Figures are not in all cases for a 20 years period. The length of the period is indicated after the name of the Station.

temperature conditions lengthen the ripening period. These considerations are of especial importance in the fruit industry.

Frosts in May are of common occurrence (see Table 8 of Appendix) and their frequency varies enormously throughout the region. At Wisley there is an average of 7 frost days in May, while at Margate May is frost-free. Average figures are of small value, however, in studying frost conditions and an examination of the table shows that the incidence of frost is an extremely localised factor dependent on varying heights and exposures. In general inland stations show a much greater number of May frosts and in each particular locality the number of days of frost occurrence varies within comparatively narrow limits. At Margate, Dover, St Leonards, Brighton, Worthing and Selsey Bill May frosts are negligible while at Wisley and Tunbridge Wells they are frequent and have occurred on as many as 13 and 10 days respectively.

Early autumn frosts are much less frequent than late spring, and the few September frosts occur, as would be expected, mainly at inland stations.

The Sussex coastal plain and the North Kent coast region (i.e., the main market-gardening area), would appear to be favoured in frost conditions, though data for the latter region is extremely restricted. The main danger to crops in this area is from strong, cold, drying East winds, which, common in early spring, may occur later, after warmer weather has encouraged



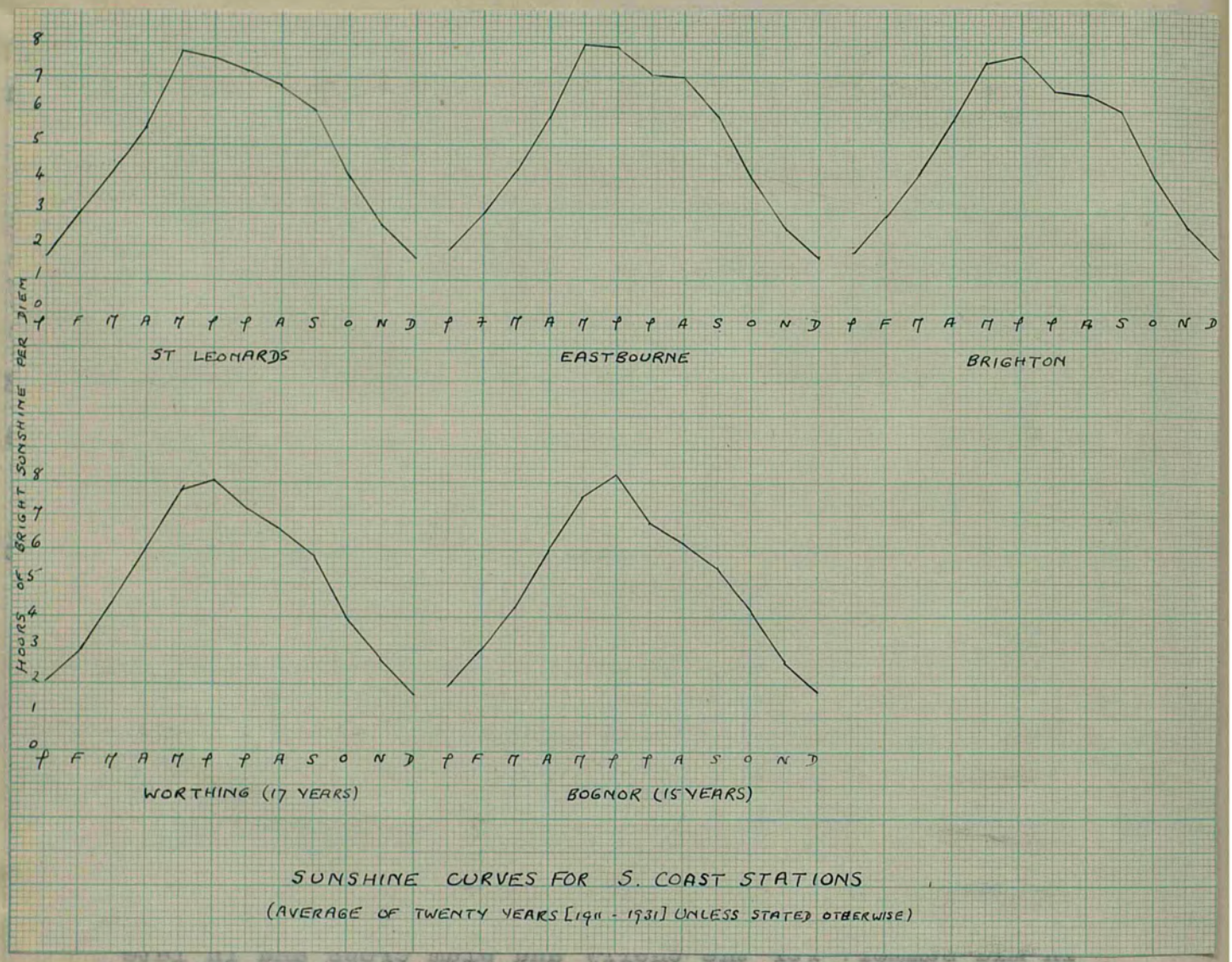
SUNSHINE CURVES FOR INLAND STATIONS IN SE. ENGLAND
(AVERAGE OF TWENTY YEARS [1911-1930] UNLESS STATED OTHERWISE)

Fig.62.

growth. The effects of these winds on the fruit trees can be disastrous, and the ideal year for fruit production is one when the spring rise in temperature is delayed until danger from these Continental winds is passed.

General temperature conditions in May, the most critical month for most crops, are comparatively dependable. Table XVI. shows variations in May temperatures at certain stations during the period 1911-1930. The number of years when the temperature varied from the normal by more than 2° is very small and is slightly more marked at inland than at coastal stations. August and September temperatures show much greater fluctuations (Table XVI.), and there is considerable risk of cold harvest weather. Sunshine conditions are of the greatest importance, especially in the fruit areas where the quality of the fruit crops is so largely affected by them. A large amount of sunshine in early summer is desirable for the soft fruit crops, in mid-summer, for the cherry and plum crops and in late summer for the apple harvest.

The area as a whole receives a high percentage of sun compared with the rest of the British Isles. The highest figures of summer sunshine occur in the S. Coast district but the total amount of sunshine received during the period June-September varies little round the coast. Margate and Bognor have a daily average for the summer months of 6·5 and Eastbourne and Worthing of 6·9. Inland stations receive less,



SUNSHINE CURVES FOR S. COAST STATIONS

(AVERAGE OF TWENTY YEARS [1911 - 1931] UNLESS STATED OTHERWISE)

Fig.62 contd.

TABLE XVI.

The Departure of Monthly Temperature from the Normal at Selected S.E. Stations 1911-1930.

		MAY			AUGUST			SEPTEMBER		
		No.of years when Temp.varied from normal by more than 2°.	No.of years when Temp.rose above normal.	No.of years when Temp.fell below normal.	No.of years when Temp.varied from normal by more than 2°	No of years when Temp.rose above normal.	No.of years when Temp.fell below normal.	No.of years when Temp.varied from normal by more than 2°.	No.of years when Temp.rose above normal.	No.of years when Temp.fell below normal.
Margate	20	2	8	8	6	6	7	6	10	6
Dungeness	20	0	11	4	2	10	5	4	11	4
Brighton	20	3	9	4	4	7	5	5	5	10
Worthing	17	1	4	8	4	6	6	4	7	5
Selsey Bill	19	1	9	6	3	8	5	4	4	11
Canterbury	17	4	7	6	1	7	5	2	6	5
T.Wells	18	3	8	5	4	6	5	6	5	6
Addington	20	3	11	4	4	8	5	4	8	7
Wisley	20	2	7	10	4	11	5	3	8	8

N.B. Figures are not in all cases for a 20 year period. The length of the period is indicated after the name of the station.

Tunbridge Wells and Wisley having 6·3 and 5·8 respectively. (see Fig.61).

The sunshine curves show a rapid late spring rise to a May or June peak and a more gradual decline. Table XVII shows

TABLE XVII.

The Number of years during the period 1911-1930 when the sunshine at selected S.E. Stations departed from the normal by more than 1 hour during June, July, August and September.

	June	July	August	September
Margate (20)	4	12	10	8
Tunbridge Wells (20)	4	8	3	9
Wisley (20)	5	8	5	5
Worthing (17)	5	6	5	4
Dover (20)	4	7	6	7

that June sunshine tends to be more dependable than either July, August or September. The large amount and dependability of June sunshine contribute to the importance of strawberry production in Kent and the early vegetable industry of SW. Sussex, while the generally sunny summers produce the peculiarly fine malting barley of the North Kent coast, in especial of Thanet and the Isle of Grain.[1]

(1) Margate is the only sun-shine-recording station of this area, therefore this point cannot be well illustrated.

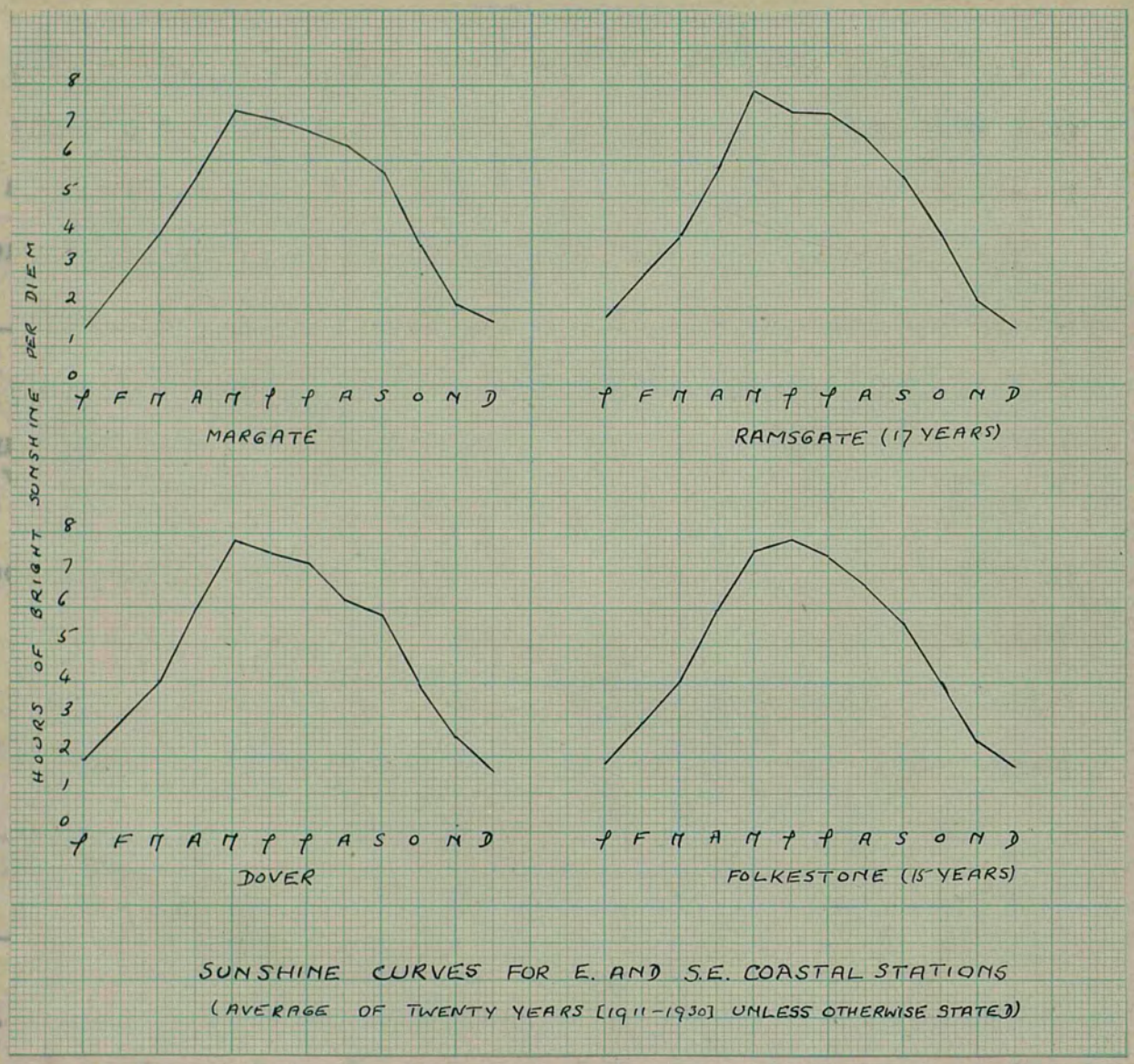

HOURS OF BRIGHT SUNSHINE PER DIEM
0
1
2
3
4
5
6
7
8
J F M A M J J A S O N D
MARGATE
RAMSGATE (17 YEARS)
DOVER
FOLKESTONE (15 YEARS)
SUNSHINE CURVES FOR E. AND S.E. COASTAL STATIONS
(AVERAGE OF TWENTY YEARS [1911-1930] UNLESS OTHERWISE STATED)

Fig.62 contd.

The marked drop in July-August sunshine is followed by a much more gentle decline in September and then by a rapid decrease in October.

The sum-total of climatic conditions is favourable to the production of crops requiring a comparatively low rainfall, comparatively high summer temperatures and a large percentage of sunshine.

These factors together with the presence of areas of particularly fertile and suitable soils and a favourable position in relation to markets, have combined to produce localities of particularly intensive arable farming, with special emphasis on market-gardening and fruit production.

Soils and Topography.

There has been no complete survey of the soils of SE. England, according to the requirements of modern soil science[1].

A considerable amount of work has recently been done on the soils of the Hastings Beds; on the Ragstone soils of the Lower Greensand; and on the alluvial soils of Romney Marsh, but much of the results are as yet unpublished. These surveys have been undertaken by the Agricultural Research Station at East Malling and by the Agricultural College at Wye and the results have shown that the soils studied exhibit very great diversity within each geologic division, in origin, composition, drainage conditions, etc., and consequently in possibilities for agricultural utilisation. This characteristic doubtless extends to those formations as yet unstudied in detail. In the Ragstone soils alone, as many as 28 different series have been distinguished. Everywhere surface conditions are much modified by either old or recent alluvial deposits. This is especially marked in both the Low and High Weald areas, and results in some of the finest quality fruit being grown at certain points on these formations.

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(1) N.B. The modern classification of soils rests on the following criteria. (1) Geology, (2) Mode of formation, (3) Topography, (4) Drainage, (5) Profile. From these considerations it is claimed that the true economic value and the distribution of soil series can be determined. (see Lee, Journal S.E. Agric.College, Vol.28,1931).

This great diversity of soils is further accentuated by the large number of geologic formations met with in the region, and the small size of certain of the outcrops which results in considerable mixing with outwash from neighbouring formations and a further diversification of soils.

Under modern conditions of chemical fertilising, the real value of a soil lies, not in its initial fertility but in its depth, structure (especially important of the sub-soil since the structure of the topsoil can be modified), and drainage conditions. Water table conditions in low-lying areas are especially important but have been little studied.

The description of the various soils which follows, must then be considered of a generalised nature. For much of it the work of Hall and Russell published in 1911, constitutes the only available information and the methods of soil analysis used in those days ~~is~~ are now considered inadequate for soil classification. Nor is the utilisation of a soil any real criterion of its value, since custom largely dictates the cropping and the general tendency is for fruit, for example, to spread out round initial fruit centres, irrespective of the value of the land on to which it is spreading and much poor orchard land is a result[1]. Where recent information is available it has been incorporated but this is almost wholly restricted to the Lower, Greensand, Hastings Beds and Romney Marsh areas.

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(1) It should be noted, however, that haphazard planting of this nature is decreasing.

PHYSIOGRAPHICAL SKETCH MAP OF S.E. ENGLAND
Heights in Feet
Over 600 Feet
600 - 400 "
400 - 200 "
200 - 100 "
0 - 100 "
Submarine Contours in Fathoms

Fig. 63.

In general it has been established that in SE. England the geologic factor is dominant in soil formation, but the climatic, and natural vegetation factors are also of great importance. The position of the region as natural forest-land in an area of comparatively low temperature and high rainfall has resulted in the podsolic nature of the majority of the soils.

Main topographic and geologic features are shown in Figs 63 and 55. Topographic features closely follow the geologic formations and the generally banded arrangement in a NW - SE direction is closely followed by the major soil types. The region was not glaciated, but drainage conditions were modified and complicated by the general climatic conditions prevailing during the glacial epoch and many of the diverse soil deposits, which occur as isolated patches throughout the region, especially on the Downs, are considered to be glacial outwash loams and gravels.

The simplest basis for a discussion of soils and topography is that of the geologic divisions.

Recent Alluvial Soils.

Except where the upland areas of the Chalk, Greensand and Hastings Beds reach the coast the whole coastline is fringed by low-lying alluvial marshland, which extends inland up the river

valleys. Romney Marsh, Pevensey Level, the Sandwich Marshes and the marshlands bordering the Thames estuary form the most extensive of these tracts and while all the streams show a breadth of water meadow apparently incommensurate with their present size, these meadows are especially well developed along the Sussex rivers, the Arun, the Adur and the Ouse[1].

The soils of all these low-lying areas have certain points in common. Due to their recent origin and method of formation they all bear resemblances to the soils of the neighbouring geologic formation.

"The alluvium of the river valleys, since it consists of material washed off the uplands and brought down by the stream, must resemble in composition the soils bordering the stream a little nearer its source, and as the streams in our area are short the alluvial soils are often almost identical with the soils on the neighbouring formations except for a little sorting of the particles effected by running water.... The alluvial Marsh soils present similar variations due to their differences of origin, both as regards the rock from which

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(1) N.B. This widespread of river alluvium has been taken as evidence of a much greater rainfall in comparatively recent times, but according to Lamplugh, it may be accounted for by former heavy flooding of these small streams in their former unregulated state, which would be aggravated by the hilly, forested nature of their sources. The streams would be choked by fallen timber etc. and flow in many ill-defined channels.

the rivers derived their suspended matter and the situation of the particular field within the marsh."[1]

The formation of the marshes is very recent and the process is still being continued as the progressive silting up of the Stour, the Rother etc. testifies. None of these regions is marshland in the true sense of the word since all have been elaborately dyked and drained and now form grazing ground of varying value.

Romney Marsh. Romney Marsh is the largest and most important of these alluvial tracts. It has become dry land over a period stretching from Pre-Roman times to within the past hundred years, On the landward side it is bordered by the old sea-cliff which runs from Hythe to Appledore, and then intermittently, with breaks for the river valleys, by Rye and Winchelsea to Pett. The seaward boundary is formed by the shingle promontory of Dungeness, still steadily accumulating.

Most of the Marsh is about 10 ft. above sea-level but sea-walls and groining are necessary to protect it in time of strong tides and it is drained by an elaborate system of dykes and sluices which open into the sea at low tide.

For the most part it consists of a treeless expanse of grass. There is a small amount of arable farming (see Figs 68 and 69[2]) but in this region of sparse population, a supply

(1) Hall & Russell "Soils and Agriculture of Kent, Surrey and Sussex. p.55.

(2) The proportion of the total cultivated land which is under arable farming is less in Central Romney Marsh than appears from the map (Fig.69) where the region is included in the larger Ashford district.

of labour sufficient for arable farming has always presented a problem.

This is the home of the Romney Marsh sheep for which Kent is famous. The pastures are, on the whole, too dry for cattle, for which, in summer, the ditch water becomes both too stagnant and insufficient.

Grazing grounds on the Marsh are of very diverse values, and soils, though for the most part noted for their richness may be both thin and poor. Certain lands are noted for their fatting qualities. Some fields will carry as many as 50 sheep to the acre and will fatten 8. On these pastures sheep may be fattened for market without any extra feed, and they may be surrounded by pastures on which sheep can only be kept growing, or which are only fit for breeding. These rich grazing grounds are never mown and it is considered of the utmost importance that they should be kept heavily stocked.

The mechanical composition of the soil is very variable and is correlated with the differing conditions under which the silt was deposited. Thus shingle and sand sometimes occur close to the surface, while the best soils are often underlain by stiff blue clay. At Lydd, light loamy sands occur, indicating that the basis was probably blown sand. Characteristically, the surface and subsoil are very similar in composition. The soil was deposited as uniform material, sorted by running water, but which being only recently formed and in many cases always

grass-covered, has offered little opportunity for the washing away of the finest material in the surface layer. In contrast to this, a complete and sudden change in composition may occur not far below the surface, reflecting a change under which the original deposit was laid down. In chemical composition, all the soils are characterised by a high content of organic matter and of nitrogen, which increases with the heaviness of the soils, and by a very low percentage of carbonate of lime. They are never acid, however, being kept neutral by the land-water which is always distinctly alkaline.

Soil analyses, both mechanical and chemical fail to throw any light on the reasons for the superiority of one field over another, nor does the botanical composition of the grass in a rich field differ greatly from that in a poor, but recent survey work has shown that pasture fertility is directly related to soil profile; that it varies with the variation in the texture and depth of the top horizon of the profile and is largely affected by drainage, climate, topography and management. There is an increase in rainfall with increasing distance from the sea and differences in relative height of only a foot will have a marked effect on drainage conditions in a flat area of this type. There is everywhere a tendency for the best fatting pastures to receive the best management so that differences in pasture values are further accentuated.

Pevensey Levels.

Pevensey Levels have formed at the W. end of the Weald Plain in a position corresponding to that of Romney Marsh at the E. end. They are not so extensive and differ from the Marsh in certain aspects of soil composition, drainage, vegetation and consequent utilisation. On the whole they are much wetter; are characterised by broad streams and running water and carry on the whole a coarser vegetation than the Marsh. They are as a result, used primarily for cattle and form the main fattening grounds for Sussex Cattle, though this breed is bred much less than formerly.

The soils are very similar to the heavier soils of Romney Marsh, a fact due to their common origin from material washed off the Wealden area, but their chemical composition shows a much bigger percentage of lime, probably due to a local deposit of shell marl.

The Thames Marshes.

The Thames estuary is lined with marshes which at certain points form wide expanses of grazing grounds. The most notable of these are the Hoo Marshes (Cooling and St Mary); the Isle of Grain; the Medway estuarine marshes; and the Sheppey, Luddenham and Graveney Marshes which reach to the London Clay cliff at Whitstable. On these marshes sheep predominate but at Graveney, where running water is plentiful, cattle are important. Pasture varies greatly here, as in all the Marsh

regions. The soils are heavy on the whole, owing to the large proportion of London Clay they contain, and are rich in organic matter.

Sandwich Marshes.

These marshes have been formed by the silting up of the Lower Stour and the Wantsum channel. They form an area more especially devoted to cattle rearing and fattening. In character the soils much resemble those of the Thames marshes. They are heavy and show a complete absence of coarse sand and gravel. In the Stonar region, a high proportion of lime is recorded, due, as at Pevensey, to a local deposit of shell marl.

River Alluviums.

The prevalence of wide water meadows along all the river valleys has already been noted. In Sussex they are locally known as "Brooks" and the most important are the Lewes and Loughton levels extending from Newhaven to Lewes, Amberley Brooks in the Arun valley and the Steyning Brooks in the Adur valley.

The former meadows were drained in the early part of the nineteenth century and now produce a strong growth of grass on which sheep are grazed early in the year, and cattle later, whilst some hay is cut. They are used for dairy work and breeding rather than for fattening. The soils of these

and the Rother "Brooks" are very similar in character to those of the broad marshland areas already considered. They are very largely composed of Weald clay.

True river meadow alluviums are more prevalent along the Wey, the Mole, the Darent and the Medway, and in each case the character of the neighbouring soils is closely reflected. At Yalding (Medway) and at Nutfield (Mole) for example, the alluviums are light sandy loams, closely resembling the Lower Greensand soils, while certain of the Wey alluviums strongly resemble the coarse Bagshot sands.

This brief account of the alluvial soils shows their salient characteristics to be great diversity of origin and composition and general, though variable fertility. "It is the depth to which the rich soil extends, the lack of a raw unweathered subsoil and the presence of a permanent water table close to the surface, which chiefly account for their fertility."[1]

The Brick Earths.

These soils represent the river alluviums of a former period and, with associated valley gravels and sands, remain as isolated remnants of old river terraces. They point to a former much greater volume of water in the rivers which is doubtless to be associated with the effects of glacial climatic conditions.

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(1) Agric. and Soils of Kent, Surrey and Sussex, p.66.

They are especially strongly developed along the Thames, Medway, Stour and shorter North Kent rivers. In Kent from the valley of the Cray E. as far as Faversham and then again E. of the Stour valley, the Brick-Earths form a belt about 30-50 feet above sea-level, very much dissected by erosion. In the Medway valley round Yalding and Hadlow and in the Stour valley round Wye, further extensive areas occur while a wide continuous belt borders the coastal plain of S.W. Sussex, stretching from Worthing W. into Hampshire and on the landward side merging imperceptibly into the Coombe rock which lies at the base of the Downs. The soil of transition is known as 'shrave' and the limits of the Brick-Earth in this region are ill-defined.

The sands and gravels associated with the Brick-Earths are of no agricultural value except in so far as they may affect drainage conditions in the Brick-Earths.

In Kent, the Brick-Earths form uniform, stoneless light loams. In Sussex they contain some stone and are slightly heavier. They are fine-grained, but silt and fine-sand, not clay, predominate and they form ideal soils for regions of low rainfall, since though they drain freely, yet their fineness prevents excessive evaporation and admits a free capillary rise of water which enables them to keep crops growing during drought periods. They dry quickly, yet do not tend to cake on the surface after drying. Resting as they do mainly on Chalk or the sands of the Eocene formation, drainage conditions

are extremely good and the general proximity of the chalklands is also advantageous because they tend to be deficient in carbonate of lime. Where they rest on Wealden soils, as in certain parts of the Medway valley, they tend to be wetter and heavier and in this region they are particularly valuable for hops.

Being arable soils, they naturally show a lower proportion of organic matter and of nitrogen than the alluvial grasslands, but their initial fertility is very high. These are the most valuable farming lands of the whole region. In Kent the Brick Earths are reckoned so valuable for hops and fruit that very little is available for other forms of arable farming. In Sussex, where they are generally heavier, and where climatic conditions differ, they are used for intensive mixed farming and may carry some pasture. There are, however, specialised regions of market-gardening in Sussex, where these soils are used.

Clay-with-Flints.

The Clay-with-Flints is a superficial deposit very extensively found on the Chalk downs throughout the region. It consists of an unstratified accumulation of the less soluble constituents of the Chalk together with a variable proportion of transported material, mainly from the Eocene formations. It occurs in ill-defined patches on the Chalk.

The greater part of the Chalk plateau of the North Downs, stretching from Guildford to the South Foreland is covered

by this deposit. It stretches almost continuously along the top of the escarpment and runs back in long tongues along the ridges of highland between the long narrow dip-slope valleys. At the base of the dip-slope where patches of Thanet Sands and Brick-Earth occur it becomes almost indistinguishable from them. The sides of the valleys are bare of the deposit and along the valley floors, it has been washed away, leaving only accumulations of flints.

On the South Downs, the deposit is confined to very small and sparsely scattered patches.

In places on the North Downs the ~~deposit of the~~ patches may have an average thickness of 15 ft. and in composition they vary very greatly according to the proportion of material from the Thanet Sands or Brick-Earths they contain.

The more purely chalk-derived Clay-with-Flints consists of dark-red to chocolate stiff sandy clay in which flints of all sizes are irregularly scattered. They give rise to a dull reddish clay soil, heavy and wet in winter and dry and caked in summer. This type of soil is found on the plateau top. E. of the Elham valley, however, it is seldom seen, and the Clay-with-Flint soils are much lighter and more loamy. This is to be associated with the much greater extent of arable farming in this region (see Fig.68).

Analysis shows that the soils vary greatly from point to point. The clay content ranges from 11% to 30%. The flints

which cover the surface in great numbers, help to warm and drain the soil, but add greatly to the difficulties and expenses of cultivation. A curious feature of these soils is that they all contain a very small percentage of lime, despite the fact that they rest upon chalk, and if they are to be used as arable lands, extensive liming is necessary. The difficulty of working these soils, their coldness and wetness in winter and their baked condition in summer, intensified by their location has resulted in their being very little cultivated. The soils of the E. end of the plateau form an exception which has already been noticed.

They are for the most part heavily wooded and account for the wood aspect, uncharacteristic of Chalk country, of the North Downs, especially near the scarp-edge where they are heaviest and most continuous. Oak and coppice are most common. Formerly the coppice consisted mainly of chestnut for hop-poles but the modern method of wiring hops has caused the value of this coppice to decline considerably.

The Bagshot Beds.

This formation occupies a wide area in N.W. Surrey, of generally low-lying land rising to a line of low hills in Bagshot and Chobham Ridges which present a slight scarp face to the S. Further E. detached patches occur as outliers on the London Clay at Esher and Sheppey but are of little importance.

Though geologically divisible into three, soil properties are fairly constant. The whole formation consists of coarse sandy material parted by thin layers of clay, and their utilisation is dependent on water conditions rather than on varying soil values. The soils contain 70-80% of sand and are thus excessively light. They are poor in soluble mineral content (especially in carbonate of lime and potash) and in organic matter but are comparatively rich in nitrogen. In its natural state the soil is practically useless. It either allows over free percolation, or, where it is underlain by a clay band, drainage may be sufficiently impeded for peat formation to set in. Naturally it is a land of heaths, bogs, and pine woods.

When, however, it is heavily dressed with chalk, and with organic and chemical fertilisers, at its lower elevations (where the water table is near, but not too near the surface), it forms a valuable soil for certain types of agriculture. It is a light, warm, easily worked soil for market-gardening and is especially good for nursery gardening. There are important nurseries of trees and ornamental shrubs on this formation. The open sandy soil stimulates the growth of fibrous roots and allows for the easy lifting and transplanting of young trees. Agriculture other than of these specialised types is poor in the extreme.

London Clay.

The most extensive outcrop of the London Clay occurs to

the S. and SW. of London. A long westerly extension forms the broad valley to the N. of the Hogs Back between the Chalk and Bagshot Beds. Along the line of the Wandle and the Thames, it is much covered by superficial river gravels and to the E. it occurs as isolated patches capping low Eocene hills at Beckenham, Bromley and Sydenham. In Kent there are considerable further patches of clay in the Hoo district, the Isle of Sheppey (with an extension on the mainland in the Lower Halstow district) and in the Blean region. In general the London Clay forms stiff intractable soils, sour, cold and wet in winter and dry and caked in summer. Carbonate of lime is markedly deficient though the soils are not poor in organic matter or nitrogen. At its worst the London Clay is only used for woodland. It is seen at its heaviest and purest in E.Kent where it forms the Forest of Blean and in Sheppey. The long line of commons in Surrey, Claygate, Epsom, Ashtead, Ockham and East Clandon, show its general inferiority. In West Surrey, however, and to the N. of this line of common, it is much lighter and sandier in its upper series. Here it forms good pasture, and when heavily limed and dressed, good arable land. It forms an important dairy-farming region.

Lower Eocene Formations.

This series, though restricted in distribution, forms one of the most important agricultural regions. Its outcrop is confined to the North Kent area where it occurs in patches of

varying extent and in general forms low rounded hills with a slightly marked southward-facing scarp. The biggest patches lie to the SE. of London in the neighbourhood of Bromley and the Crays; in the region stretching along the coast from Rainham to Faversham, where the beds extend for an average distance of about three miles either side of the main London road; and in low line of hills reaching from Canterbury to Ash.

In Surrey the outcrop is small and in Sussex it is almost completely obscured by Coome rock and Brick Earth.

The formation is divided into three. The Upper or Oldhaven and Blackheath Beds, the Woolwich and Reading Beds and the lower or Thanet Sands. The soils of the last two divisions are almost indistinguishable and will be considered together. They consist of fine loamy, easy-working sands with drainage and drought resisting properties comparable to those of the Brick Earths. They are well supplied with subsoil water which is held up by thin clay partings near the base of the series. They are somewhat deficient in lime but comparatively rich in mineral and nitrogenous plant foods, and with proper and careful management they form very rich and highly prized arable lands. All kinds of arable farming are practised. There are notable areas of fruit and hops (though only the heavier districts are good for hops); market-gardening and intensive mixed farming. It is common for a farm on these soils to be worked in conjunction with marsh grazing lands.

The upper division is a much lighter coarser formation, distinguished by the large number of pebbles it contains. It is most extensively developed as cappings on the Thanet Sands to the SE. of London where it is agriculturally worthless and gives rise to the commons of Blackheath, Hayes and Wickham. In E.Kent the beds are thin and form cappings on the Eocene outliers between Canterbury and Ash. They are worked in conjunction with the underlying Thanet Sands and carry crops such as strawberries and other small fruit suited to their light nature.

Along the North Kent Plain, the Brick Earths, Thanet Sands and chalk soils lying along the base of the dip-slope of the Downs form together a region of diverse and very fertile arable farm-land.

The Chalk Formation.

The Chalk Downs form the most striking topographic feature of the region. The greatest heights are reached on the North Downs between Caterham and Woldingham, where the escarpment rises steeply to 882 feet above the gault valley, though the South Downs are continuously higher. It is not proposed to give any detailed account of the familiar topography of the Downs here. From an agricultural point of view, the North Downs are, in general, more important E. of the Medway where average elevation is lower, the South Downs E. of the Arun

Valley, where the true rolling Downland country is best developed. Though in origin, structure and composition the North and South Downs are similar, they show great diversity in soil development and land utilisation.

The true chalk soils show considerable uniformity in quality. They are good grey-brown loams, and though in composition they may vary enormously, both in the amount of carbonate of lime they contain (which ranges from 1·5% to 66%), and in the ratio of fine to coarse particle content, yet this variation affects the general textures less than usual. The finely grained soils as a rule contain the higher carbonate of lime content and are thus kept open and in texture much resemble the coarser soils. They are all very rich in plant food, though they tend to lose their fertility rapidly on the arable lands, and extensive manuring is necessary.

The poorness of the chalk soils in some areas is due not to their quality but to their thinness and difficulties of farming them are concerned rather with questions of water supply than of soil properties. The chalk is everywhere waterless. The general height of the area and the porosity of the rock makes the water table very far below the surface on all but the lower areas of the dip-slope. At the edge of the escarpment wells are usually over 200 ft. deep and the watering of stock is difficult. Arable farming is confined to the lower levels near the spring line along the base of the scarp, and

to the lower dip-slope along the floors and lower slopes of the coombes. These coombes often cut back into the chalk and reach down to the water table and consequently often contain streams which are frequently intermittent "winterbournes". On the South Downs a certain amount of water for stock is obtained on the upper lands from dewponds. These have a puddled clay bottom and lie a little back from the edge of the scarp where they act as natural collecting grounds for the rain.

On the North Downs there are two main belts of the true chalk loams. The lower slope of the scarp is followed all round by a band of rich chalk marl, which E. of the Darent valley merges imperceptibly into the calcareous upper layers of the Gault, and W. of the Darent into the calcareous soils of the Upper Greensand. This chalk marl is a thick white sticky loam, warm and sunny due to its general S. exposure, and well supplied with ground water which is held up by the underlying Gault. It is almost entirely under the plough, being especially valuable for cereal and root production. The second band of chalk loam occurs along the lower dip-slope region, the intervening area being largely covered with Clay-with-Flints. Here, where the soils are thin, characteristic open sheep-walks occur and where the soils are sufficiently thick, there is opportunity for arable cultivation. Tongues of arable land under fruit, hops, and fodder crops may be observed following up the valley floors. These are better developed to the E. of the Darent

valley where, as already stated, cultivation on the low-lying chalk loams forms part of the generally intensive arable farming.

At the E. end of the North Downs, where the chalk outcrop broadens considerably and drops in general elevation, the loam soils of the chalk type are much developed and occupy all the area stretching roughly from the Dover-Canterbury road to the Eocene hills. They give rise to an area of good sheep pasture and arable farming. In the Isle of Thanet these soils are well-developed and of a high quality and practically the whole area is under the plough. Recent work has shown that many of these soils are really drift soils, or "Plateau loams". They form mellow loams of a fine texture and consistency, excellently drained. The fertile plateau loams of the Isle of Thanet appear to be of this type and to have no relation to the underlying chalk[1].

None of these soils, whether sedentary or drift, appear to have the highly developed moisture resisting properties of the Brick-Earths and Thanet Sands and all farming operations are directed towards conserving the moisture. Drought-resisting plants like the deep-rooted lucerne and sainfoin are characteristic along the dry N.Kent area (see Fig.83).

True chalk soils appear to be much more extensively developed along the South Downs where they give rise to

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(1) Lee, "The Possibilities of an International System for the Classification of Soils." J.S.E. Agric.College. Vol.28. 1931.

typical sheep country. "Open grassy Downs on the heights for the store stock and the ewes, with the homesteads in the great hollows of the hills surrounded by wide expanses of open fields over which the fold moves at least once in the rotation."[1] Sheep are the basis of the agriculture although their importance has much declined of late years.

This typical downland country is most developed Eastwards from the Arun valley to Beachy Head. Westwards the Downs are heavily wooded, a circumstance which seems not to be due to differing soil values, but which is probably correlated with the heavier rainfall and greater average elevation of this region. The open South Downs are usually covered by a thin layer of dark flinty soil, but in the coombe bottoms the soil may have accumulated to a depth of two feet or more, and gives opportunity for arable farming round the farms which lie in the hollows.

Upper Greensand.

This series forms a narrow platform of land below the chalk marl. It is slightly more elevated than the lowest Chalk region and than the Gault which borders it on the inner margin. It is well developed along the foot of the scarp of the South Downs, forms but a very narrow outcrop in Surrey and is almost completely absent in Kent. It is a calcareous

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(1) "Soils and Agric. of Kent, Surrey and Sussex." p.100.

sandstone and forms a heavy retentive soil, almost black when wet and almost white when dry. It is fairly constant in composition, well-balanced and rich in plant food and deficiencies are due rather to water conditions than composition. It is most developed in a region of fairly heavy rainfall and natural drainage is sometimes impeded by a layer of impervious stone close to the surface, while it is so placed as to receive a considerable water supply from the base of the Chalk. Despite the resulting tendency to over-wetness, the area is very largely under the plough. Wheat production and fodder crops in connection with dairying is the more common form of agriculture, but in the Farnham and Midhurst district, the rich composition of the soil resulted in much of the land being planted with hops, though the acreage has very much decreased of late.

The Gault.

This formation everywhere forms low-lying land, and is nowhere very extensive since its total thickness is only about 200 ft.

In Kent, it forms the narrow Vale of Holmesdale, lying between the Chalk scarp and the Ragstone ridge and it seldom averages more than two miles in width. In Surrey, from Dorking to Farnham it shrinks to a mere strip and then suddenly broadens out to a width of about 6 miles in the Alice Holt

Forest area, but only a small part of this extension lies within the Surrey border. In Sussex it is continuously developed as a shallow valley between the Upper and Lower Greensand but owing to the gentle slopes and restricted outcrop of Lower Greensand in this area, the Gault forms a much less marked topographical feature than along the North Downs.

In its pure state the Gault forms a stiff, tenacious black clay soil, deficient in carbonate of lime and strongly impregnated with iron compounds - a black, acid, peaty soil. There is, however, great variety between the upper and lower beds of the series, the upper being strongly calcareous and almost indistinguishable from the overlying Chalk Marl and Upper Greensand, while the lower beds become sandy in character from their contact with the Lower Greensand. In addition, its position as a narrow valley between high chalk and high sandstone cause it to be much overlain by outwash from these formations - a character much more marked in its N. outcrop than in its S. It suffers always from an over-abundance of land water, receiving as it does, the chalk springs and the dip-slope drainage of the Lower Greensand. Where it can be drained and is lightened by either chalk or sand admixture it will form good pasture land, and some grass-orchards are to be observed though they are poor in quality. It has always been noted for the quality of its oaks and where it is too stiff and ill-drained for pasture it is largely in woodland.

The Lower Greensand.

This division, which forms the escarpment lying inside the Chalk region and separated from it by the Gault and Upper Greensand, gives rise to very valuable and very barren soils, - its diversity has already been remarked. Lithologically it consists of four formations, the Folkestone, Sandgate and Hythe beds, and the Atherfield clay. The Folkestone beds, the highest in the series, are characterised by open coarse-grained sands which vary greatly in extent. They form the less-elevated lower dip-slope of the ridge and are but poorly developed in the Maidstone district, but E. and W. of this they assume greater importance and are marked by a line of commons. In West Surrey, Blackheath Common, Puttenham, Crooksbury, Thursley, Frensham and Farnham commons are on the Folkestone beds, while in Kent, between Ightham and Limpsfield, Hothfield and Lenham much heathland occurs. In the S. commons again are found on the Folkestone Sand as far E. as the Adur, but from this point to the S. the Folkestone beds cease to form a distinct series. E. of the Stour, the general coarse-grained nature of the sands is much modified and they are largely under cultivation but elsewhere they are too dry and coarse and support only heath formations. Where the drainage is held up by underlying partings of clay or by an iron pan, peat bogs form.

The Sandgate Beds vary very greatly, both in their composition and in the size of their outcrop. Nowhere very

extensive, they are important as the water-bearing formation of the Lower Greensand. Although not forming true clays they are very much heavier than the overlying Folkestone beds and springs are thrown out at their junction with the latter. In addition many streams of the region flow for some distance along the outcrop of these Sandgate beds whose character thus becomes greatly modified by alluvial deposits. In the Godalming district the calcareous Bargate stone is considered to belong to this formation and gives rise to a distinct type of free-working loam which enjoys superior water conditions and is highly farmed.

The most important division of the Lower Greensand is the Hythe Beds. This formation is of considerable thickness and forms the escarpment of the Lower Greensand Ridge. From Hythe to Maidstone the scarp rarely rises above 500 feet, but in the Leith Hill district of W.Surrey, it reaches nearly 1,000 ft. From Haslemere to the SE. the ridge rapidly decreases both in height and width and E. of the Adur valley gives rise to no marked topographic feature.

From Hythe to the Shode valley (near Ightham), these beds are highly calcareous and consist of layers of hard calcareous sandstone, the Kentish "Rag", interbedded with soft argillaceous beds, the "Hassock". They give rise to the highly fertile Ragstone soils on which the Mid-Kent region of intensive fruit and hop cultivation is developed. In the

neighbourhood of the Medway, this region is some six miles wide and is trenched by the valley of the Medway, but it narrows considerably to the E. and W. of this line. In general these ragstone soils are deep stiff sandy loams of the podsol type. They vary greatly in variety and value and they are further complicated by the very widespread occurrence of the brick-earth type of alluvium throughout the region of their maximum development. In depth and texture they are frequently ideal, while not infrequently their fertility and richness exceeds the ideal. They are frequently characterised by a layer of "pug" four to six inches deep, at the base of the subsoil. This is a dark brown layer of insoluble humic material which has been leached out of the top layers of the soil and forms a pan when it reaches the underlying calcareous rag. It constitutes a reservoir of rich nitrogenous food material, not always advantageous, especially to fruit crops where it induces exuberant growth rather than the production of high quality fruit. (This 'pug' was observed in a section where alluvial Brick-Earth overlay the Hythe Beds, but is also frequently present in the sedentary soils).

Drainage conditions are generally good, the soils are free and open and yet sufficiently fine in texture to prevent over rapid percolation. Here again, however, there is great variety, and local variations in topography, or the presence of locally stiffer subsoils may give rise to bad conditions.

West of the Shode valley the ragstone disappears and its place is taken by chert. The resultant soils are lighter and sandier and resemble the soils of the Folkestone beds. The large admixture of glauconite granules, however, causes the Greensand soils in general to be heavier than the nature of the underlying rock might warrant and in the Sevenoaks district large areas of the scarp region appear to be suitable for fruit cultivation but are not, as yet, extensively used.

Westwards from Sevenoaks, the sandy nature of the Hythe beds increases and in the Leith Hill, Hindhead region they are agriculturally worthless. In Sussex, from Midhurst to the Arun valley they form light but cultivable soils and to the E. of the Arun they have few distinguishing features and form no agricultural district distinct from neighbouring formations.

The lowest formation, the Atherfield Clay has a very narrow outcrop and is largely covered by downwash from the overlying sandy beds. A good sandy loam results, well watered by springs from the Hythe beds and it is largely cultivated.

The importance of certain of the Greensand soils in SE. agriculture cannot be over-estimated. The whole of the Maidstone area forms a region of intensive cultivation comparable to the N.E. Kent region. Fig.69 which shows the proportion of arable land to the total cultivated land fails to give sufficient emphasis to this region, since the divisions on which it is based include in this region much chalk grassland to the N. of the Maidstone ragstone area.

The Weald Clay.

The broad flat plain which sweeps round inside the Lower Greensand escarpment forms a comparatively uniform, sharply-defined topographic feature. From a width of 4-8 miles through Kent and Surrey, it broadens out on the W. into a large expanse, about 12 miles fron N. to S. and 16 miles from E. to W. It then contracts to the S.E. until the alluvium of Pevensey Levels is reached. It forms low undulating country crossed by faintly marked ridges where thin bands of limestone underlie the surface. The stiff intractable clay soils to which it gives rise are lightened by local admixtures of sand and from point to point their character may be much modified by the presence of patches of old alluviums. In the wide W. area, there is a certain admixture of sand residual from the former extension of the Lower Greensand, which becomes consolidated in the Horsham area into thin layers of fissile sandstone and the Medway region is especially marked by the spread of recent and old alluviums.

The true Weald Clay soils are stiff and tenacious, very deficient in carbonate of lime and in certain elements of plant food. They suffer from an over-abundance of surface water, and the difficulties of drainage are increased by the impermeability and depth of the subsoil (this is Cobbett's "bottomless clay"), and by the general lack of appreciable slope in the topography.

The heaviest soils are found near the seaward limits of the formation in E.Kent and E.Sussex. In the W. the soils, owing to the sandy admixtures already referred to, forms heavy loams, in themselves suitable for arable farming but whose value is greatly depreciated by their stiff clay subsoil and consequent bad drainage conditions. Almost everywhere the Weald Clay forms poor pasture, with an increasingly small amount of arable (mainly cereals and roots) farming. Dairy cattle are kept; Romney Marsh sheep are wintered, and a good deal of cattle breeding is carried on.

There are extensive areas of good fruit and hop plantations on the Low Weald, but they are almost always developed on alluviums and brick-earths overlying the clay and farming on the true Low Weald country has always been poor, backward and unprofitable.

The Hastings Beds.

These beds form the High Weald, the central core of the region. A rough oval, extending about 53 miles from E-W and 26 miles from the N. to the S. coast, it is a hilly tract of country of diversified topography, reaching a height of 800 ft. at Crowborough Beacon but averaging only about 400 ft. The topography is much sharper and more diverse than this low average height might suggest. From this region radiate the innumerable headwaters of the Wealden drainage system and though the main rivers, with their principal tributaries have

reached their base level of erosion, there are innumerable small streams which are still cutting sharply downwards and valleys everywhere are steep-sided and narrow. One result of this radial drainage is that within the area, all river drifts are of Hastings Beds origin.

The formation is divided into three series, the Tunbridge Wells Sand, the Wadhurst Clay, and the Ashdown Sand. The Tunbridge Wells Sand contains subordinate beds of clay, which, in the E.Grinstead district attain sufficient importance to be mapped separately, but for the purposes of soil considerations, the Tunbridge Wells Sands and the Ashdown Sands may be classed together as giving a "lighter than silt loam" and the Wadhurst and E.Grinstead clay as giving a "heavier than silt loam". In general soil conditions are much more favourable in the E. part of the region, the W. is largely occupied by the heaths and woodlands of St Leonard's, Lilgate and Ashdown Forest. In the E. in the upper Teise valley most valuable fruit lands are found.

The soils of this formation in Kent (where it attains its greatest agricultural importance) are at present being investigated and a certain amount of detailed information is already available[1].

The diversity of the topography is reflected in the diversity of the soils and as many as 16 soil series have been

(1) "Soils of the High Weald". Furneaux.

distinguished in the High Weald of Kent alone. This diversity is due more to complex drainage conditions than to any other factor. Although the soils originate from either a sandy or a clayey substratum, the sandy soils are often of as compact a nature as the clayey and differences in soil profile are often dependent on the alluvial and sedentary nature of a series, independent of a possible common parent material. Alluviums cover wide areas, not only in the river valleys, but everywhere, even on the steepest slopes and none of the soil series has been found to be associated with any particular topographic position. Topography is responsible for the occurrence of each soil series in small and frequently-recurring patches, - a very striking feature of High Weald soils in general. Both the sands and clays are often so compacted in their lower layers that they become water-logged, while the tendency of many of them to "run together" on the surface under the influence of rain-washing, makes surface drainage often difficult.

As a whole the soils are fertile and do not suffer from drought and in general their utility is determined by local conditions of drainage, and these vary greatly.

In the Kentish area it has been determined that the well-drained soils represent about 41·5%, the poorly drained 45·5%, and the badly drained 13·0% of the total area.

Agricultural utilisation of the High Weald is, as a result,

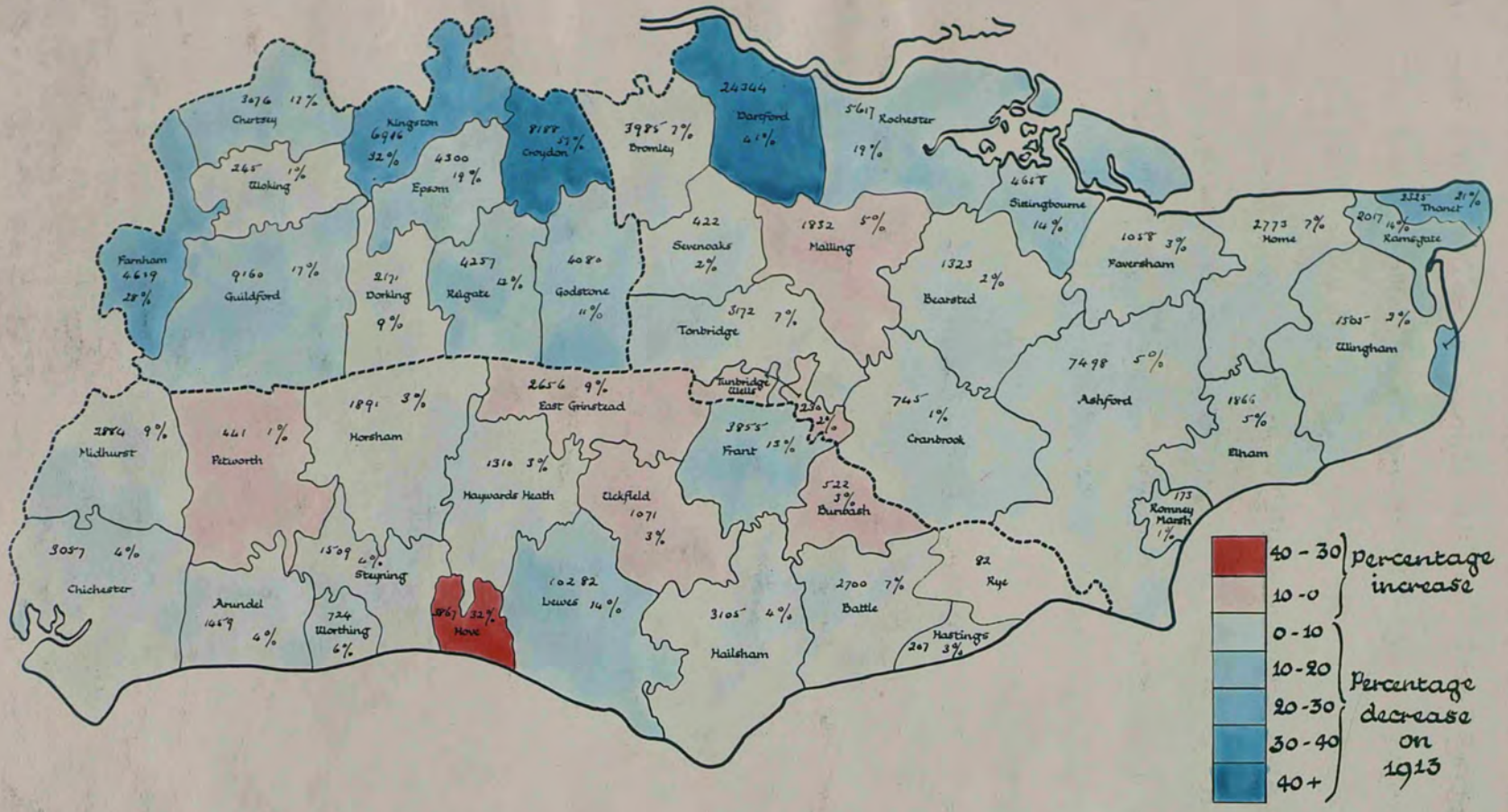
extremely diverse, and small scale in character. There is much poor woodland and poor grassland. Good pasture and arable farming is largely confined to the valley floors, but fruit cultivation spreads up the slopes where drainage conditions are sufficiently good.

In the preceding sections the physiographical background of the agricultural industry has been described. To this must be added a description of the social and economic background.

An analysis of the social background resolves itself into two parts. A consideration of general population development in so far as it affects agricultura, and a consideration of farming population itself, its type and distribution and the growth of agricultural institutions.

The widespread and rapidly increased urbanisation of the area affects agriculture in two ways. The first and more important, is the resulting existence of a big and important local market for agricultural produce and the second is the actual reduction of land available for agricultural use.

The importance of the first factor has been clearly demonstrated during the past ten years of acute agricultural depression. The general movement throughout the country from arable farming with cereal production to grass farming with milk production has been comparatively easy to accomplish on small farms, where management permits of flexibility and has been assured of a greater degree of success where it has been possible for the farmer to turn producer-retailer to a local population. In the S.E. these conditions reach, perhaps their highest degree of fulfilment, though varying greatly from point to point within the region.



VARIATION IN ACREAGE OF TOTAL LAND UTILISED FOR AGRICULTURE (except woodland)
1913 – 1930

(For marked increase in certain areas see footnote on page 177).

The areas of greatest soil fertility and consequent greatest agricultural utilisation lie nearest to the main centres of population. In Surrey, the Tertiaries, the river valley alluviums and the lower dip-slope of the Chalk coincide with the greatest urban development. In Sussex the maritime plain of fertile soils is near both to the South coast watering places and to the Portsmouth area. In Kent a similar close relation between soil fertility and population concentration exists.

As a result the depression has not been generally so acute in the S.E. as in more purely rural areas. This advantage of nearness to points of consumption is, however, a diminishing one in face of the development of the organisation of marketing and transport of produce.

Changes in habits in the urban population are reflected in changes in agricultural practice. The mechanisation of London transport and of the Army in the Aldershot area has deprived the market-gardeners on the light soils of N.Surrey of their cheap manure supplies and is one of the causes of the decline of market-gardening in Surrey

The decline in the total acreage of land utilised for agriculture during 1913-1930 is shown in the following Table and the percentage variation by districts in Fig.64[1].

(1) According to the Ministry of Agriculture, there was a difference in the collection of data between the two dates, which resulted in the return of land as rough grazings in 1930 which was either returned as woodland in 1913 or not returned at all. This accounts for the increase shown in some districts, while the only effect it has on the decreases throughout the region is possibly to weaken them.

TABLE XVIII.

Decrease in amount of land utilised for Agriculture (excluding woodland) in Kent, Surrey and Sussex 1913-1930.

	Acreage	Percentage Decrease
Kent	39987	5%
Surrey	47012	17·7
E.Sussex	12461	3
W.Sussex	11283	4

The decrease is most marked in Surrey where there has been the greatest urbanisation, the Croydon and Kingston divisions showing specially marked decreases.

In both Surrey and Kent, the greatest decreases, both actual and relative, occur on the more fertile soils (Compare Fig.69 showing percentage of total cultivated land formed by arable land), and this fact has its effects on the development of market-gardening and fruit production in these areas. Insecurity of land tenure in the face of urban development makes the farmer unwilling to embark on any form of cultivation which requires a big capital expenditure and gives no immediate returns.

Tables XIX and XX show the variation in the total agricultural population in S.E. England and the percentage they form of the total population of the area. Besides farmers and agricultural labourers, "total agricultural population", as enumerated in the Census returns, includes market-gardeners,

seedsmen, nurserymen etc. In 1921 and 1931, the domestic gardeners are not classed separately from those engaged in agricultural industry, but in 1911 the percentage they formed of the total agricultural population was in Kent 11·8%, in Surrey 30·3% and in Sussex 13·4%.

TABLE XIX.

Total Agricultural Population in S.E. England.

	1911	1921	% Decrease on 1911.	1931	% Decrease on 1921
Kent	59029	58601	0·7	51543	12·0
Surrey	32714	30817	5·8	30556	0·8
Sussex	43887	42563	3·0	40267	5·3

TABLE XX.

Percentage of total population engaged in agricultural pursuits.

	1911	1921	Intercensal Variation	1931	Intercensal Variation
Kent	5·6	5·2	-·4	4·2	-·8
Surrey	3·8	3·3	-·5	2·6	-·7
Sussex	6·6	5·8	-·8	5·2	-·6

Kent has the largest agricultural population but in Sussex it forms a slightly higher proportion of the total population.

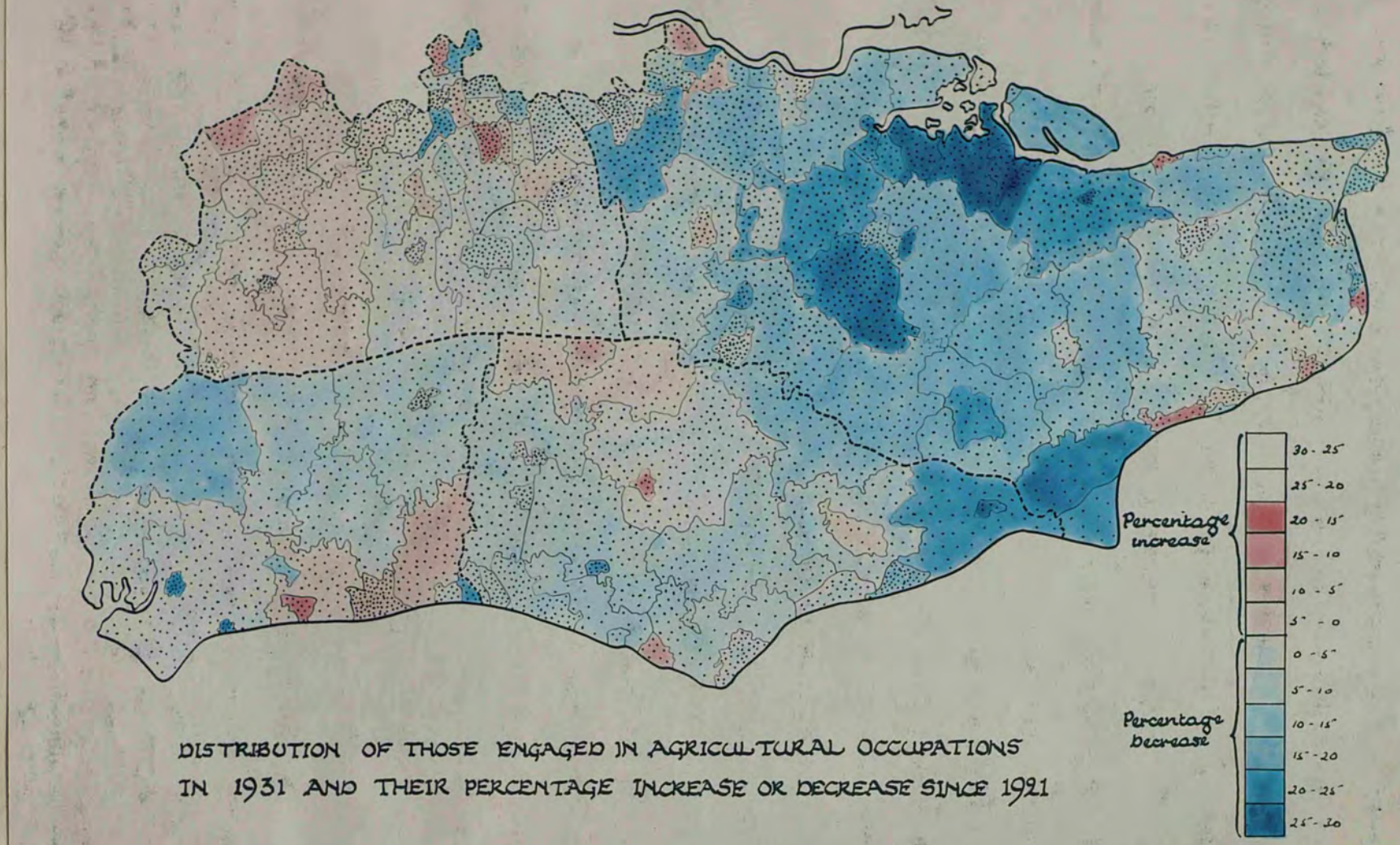


Fig.65. Note. Tendency for greatest percentage decrease to occur in areas of most dense agricultural population.

Everywhere the decline has been marked since 1911. It is a feature of the general development of the region and not only of the present depressed condition of agriculture. In Surrey the decline was more marked in the 1911-1921 decade and this is to be correlated with the early spread of London to the S.W., while the very slight decrease in the 1921-1931 period is probably due to a rise in the numbers of domestic gardeners, and others attendant on the urbanisation of the area, which balances the drop in the numbers employed in the agricultural industry proper.

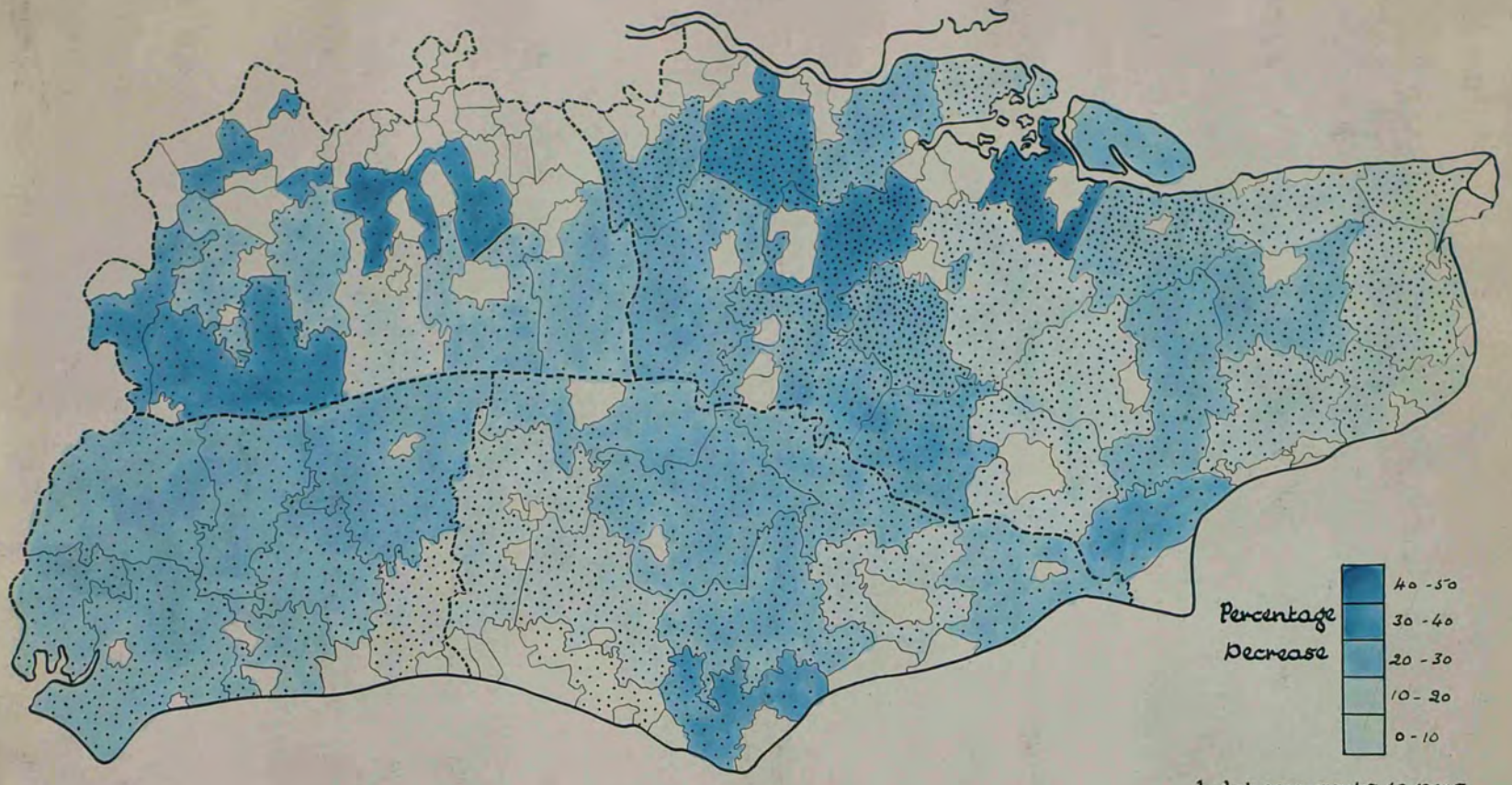
The relative importance of agricultural industry in each county has fallen steadily.

In Fig.65 the distribution of the total agricultural population in 1931 is shown together with the percentage increase or decrease by districts since 1921.

Apart from the densities in urban areas which are mainly accounted for by domestic gardeners, the main concentrations of the population occur in N. and Mid-Kent, with a subsidiary area in E.Kent. The High Weald, especially the E. part shows a slightly higher density than surrounding areas[1].

With the general exception of urban areas the tendency has been for the greatest percentage decrease in agricultural

(1) N.B. The tendency for the divisions on which the map is based to cut across physiographic divisions, to a certain extent masks the real concentrations. This is especially true of the Sussex maritime region where Westhampnett and E.Preston include large tracts of thinly settled Downland.



DISTRIBUTION OF FARMERS AND AGRICULTURAL LABOURERS IN RURAL DISTRICTS IN 1931 AND THEIR PERCENTAGE DECREASE SINCE 1921

Fig.66. Note (a) The general and widespread decrease.
(b) The intensity of the decrease in certain of the more fertile areas of Kent and in West Sussex generally.

occupation to occur in regions of greatest density e.g. in the Sittingbourne and Maidstone areas, and that this is a reflection of conditions in the agricultural industry proper is shown in Fig.66 which shows the distribution of farmers and agricultural labourers in Rural Districts and their percentage decrease since 1921. Again there is a marked tendency for high decrease in regions of high density accompanied by a general decrease throughout the region.

Table XXI shows the number of farmers in the region and their decrease since 1912[1].

TABLE XXI.

No. of Farmers in Kent, Surrey and Sussex in 1921 and 1931 and their percentage decrease 1921-1931.

	Total		% Decrease	In Urban areas		% Decrease	In Rural areas		% Decrease
	1921	1931		1921	1931		1921	1931	
Kent	6545	6332	3·2	1016	835	17·9	5529	5497	·5
Surrey	2123	1949	8·2	666	578	13·2	1457	1371	5·9
Sussex	5592	4947	11·5	764	641	16·0	4828	4306	10·8

Decrease has been most marked in Sussex, the county of least specialised farming, and least marked in Kent, the county of most

(1) For Table giving the variation in the number of farmers in each Rural District, see Appendix, Table 9 .

specialised farming. This is correlated with the fact that there has been the biggest shift from arable to grassland farming in Sussex (see Fig.72 which shows variations in grassland acreage), and a consequent general extension in the size of farms. In urban areas where the decrease is very marked, farming has been crowded out by building operations.

This decrease in farmers has not been general throughout the area[1]. Cranbrook, Ticehurst, Battle and Tenterden, i.e., the E. High Weald area in general shows an increase, while the areas of marked specialised production show either an increase or very little variation, e.g. Dartford, Faversham, Maidstone.

From a general survey of the size and distribution of the agricultural population, the following factors emerge. Although the farming population as a whole has decreased, in certain areas it has increased, indicating a decrease in the size of holding. This points to both greater intensification of farming operations and lower costs of production, and is more marked in regions of specialised farming. The prosperity of the farmer to-day has been shown ~~shown~~ to be largely commensurate with his independence of hired labour[2]. There has been a general reduction in the number of labourers due to (1) the widespread change from arable to grassland farming (2) the reduction in the size of holdings in certain areas, referred to above, (3) the increased use of

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(1) See Appendix, Table 9.
(2) See Messer, "The Agricultural Depression of 1931".

machinery. This is especially marked in the fruit-growing areas, where capital outlay must in any case be high and where the success of the crop depends on the concentration of much work into short periods, e.g. at spraying times. For the much improved methods now general the farmer is increasingly using machinery. This, however, is not necessarily accompanied by a big decrease in labour, since the amount of cultivation now considered necessary in the orchard has increased enormously and whereas one spraying per season formerly sufficed for most farmers, now eight are considered necessary.

Some indication of the general size of farm holdings is shown in Table XXII. The high proportion of holdings of less than 50 acrea is everywhere marked. It is highest in Surrey and lowest in W.Sussex. W.Sussex is characterised by its relatively high percentage of big farms - farms of over 150 acres. A comparison with the figures for 1913 shows the balance between the various types of holding is but little altered though there has been a considerable reduction in the total number. In Surrey, small holdings have decreased somewhat in importance and this is attributable to the decline in market gardening in that county (see below). In all counties there is more emphasis on the 50-100 acre farm than formerly.

Table XXIII shows some classification of farms. The importance of arable farming in W.Sussex is shown by the high percentage of arable and mixed farms. In E.Sussex pasture farms

TABLE XXII.

Number and Size of Agricultural Holdings in Kent, Surrey and Sussex and Percentage each class forms of Total. 1930.

	1-5 acres	5-20 acres	20-50 acres	Total 1-50 acres	50-100 acres	100-150 acres	150-300 acres	Over 300 acres	Total
Kent	2397	3058	1964	7419	1577	827	956	311	11090
Surrey	807	975	618	2400	474	252	264	89	3479
E.Sussex	1020	1523	1063	3606	868	451	386	128	5439
W.Sussex	604	737	592	1933	425	242	311	190	3101
	Percentage of Total formed by each class of holdings 1930.								
Kent	21·5	27·4	17·6	66·5	14·1	7·4	8·6	2·7	
Surrey	23·2	28·0	17·7	68·9	13·6	7·2	7·6	2·5	
E.Sussex	18·7	27·9	19·5	66·1	15·9	8·2	7·0	2·3	
W.Sussex	19·4	23·7	19·1	62·2	13·7	7·7	10·0	6·1	
England	19·1	25·4	19·0	63·3	15·1	8·2	9·5	3·5	
	Percentage of Total formed by each class of holdings 1913								Total No. of holdings 1913
Kent	21·0	27·3	18·0	66·4	13·5	7·3	9·0	3·6	11426
Surrey	24·8	29·7	16·5	71·1	11·7	6·3	8·1	2·3	4727
E.Sussex	19·1	28·4	18·7	66·3	15·4	7·8	7·1	3·2	5760
W.Sussex	21·8	25·5	16·3	62·6	12·5	7·8	9·8	7·0	3324
England	21·9	27·4	17·3	66·6	13·0	7·3	9·1	3·7	

TABLE XXIII.

Different types of holdings in Kent, Surrey and Sussex.

A. Proportion of Total Acreage of holdings* above 20 acres occupied by:

	Arable Farms (a)	Pasture Farms (b)	Mixed Farms (c)
Kent	19·9%	39·3	40·8
Surrey	11·3	40·6	48·1
E.Sussex	5·3	54·6	40·1
W.Sussex	22·5	24·6	52·9

(a) consisting of 70% or more arable land.
(b) " " 70% " " permanent pasture.
(c) Mixed farms not included in (a) and (b)

B.

	Total No.of Fruit & Vegetable Farms**	Average size of Fruit & Vegetable Farms.
Kent	2792	27 acres
Surrey	402	17 "
E.Sussex	294	10 "
W.Sussex	387	11 "

* This acreage does not include the acreage of fruit, vegetable and poultry farms. This affects the Kent figure of average size of holdings, making it slightly smaller than it probably is, but has no appreciable effect on Surrey and Sussex.

** Holdings grouped as Fruit and Vegetable farms are those of which half the area or more appeared to be devoted to the growing of fruit and vegetables.

(Compiled from Ministry of Agriculture statistics.)

attain their greatest relative importance, while in Kent and Surrey, arable and mixed farms again predominate, though to a less marked degree than in W.Sussex.

The large number of fruit and vegetable farms in Kent indicates the specialisation in this type of farming when compared with Surrey and Sussex. Even in Kent, however, the degree of specialisation is not great. Of a total orchard acreage of about 70,000 acres (in 1930) only about half of it was on holdings grouped as fruit farms (i.e., on those of which half the area or more appears to be devoted to the growing of fruit). Pure fruit farms are comparatively rare and it is still the common practice to grow fruit and hops as part of general farm management. In this respect the Kentish fruit region differs markedly from the Worcestershire area and from the more recently developed Essex region, but the tendency in Kent is towards specialisation. There are three types of Kent fruit farmer:
(1) The man who grows fruit as part of his general farm management. This is the most general and more conservative type.
(2) The big-scale grower, who by reason of mass production and control of markets by his own selling organisation makes a good living. There are several growers of this type, and the extent to which their profits are due to good production, or to good organisation in marketing is difficult to estimate.
(3) The fruit specialist, who is rare as yet.

The persistence of old and often uneconomic methods in Kent are largely associated with the deep-roots the industry

has in this the oldest fruit and market-gardening area of England (the difficulty of changing established custom is perhaps greater in agriculture than in any other industry), and the nearness of the London market, a market which absorbs good and bad crops alike with often an insufficient margin of price for the good crop to encourage the grower to adopt more careful methods. Moreover complete specialisation is not necessary to high-grade production and, when it is not supported by assured markets and prices, may lead to difficulties. In the recent depressed condition of the Hop industry, the Kent and Sussex hop specialists found themselves in a worse position than those whose farming was more diverse. With increasing control, either by cooperation, or Government authority, of marketing and prices, specialisation is likely to develop. Everywhere the farmer is becoming more scientific. There have been various moves towards cooperation and improvement in marketing among the farmers themselves and increased and much wider use is made of technical advice from the Research Stations and County Educational authorities and this often in connection with general economics. The change in attitude of the farmer is illustrated in the following extract from a report on agriculture in Surrey prepared in 1932 by the Agricultural Organiser of that county.

"Advisory work on the farms and in the markets.... has changed its character considerably. In 1920, the information

required was as to the best mixture of fertilisers to use for crops, the best variety of seed to sow, the best balance of concentrates to give to cows and other stock, the most reliable remedies for diseases of crops; all, in fact, for increased production on the lines on which the farm was then being conducted. With the fall in prices and the development of Agricultural Economics.... questions as to whether the system of farming was right or how it could be improved became more frequent. In addition to an ever-increasing request for information on the lines first mentioned, the most important work became concerned with questions of farming policy for individual farmers."

In Kent a big incentive to the production of high grade produce of standard quality is being given by the developing canning industry (see Section on Fruit production) and change in farming policy already associated with growing specialisation is likely to be further and more rapidly developed on this account.

Agricultural Production and Marketing.

This section deals with the production and distribution of the main crops and stock illustrative of the various types of farming within the area under discussion, and with the variations in production since the pre-war period. The geographic factors underlying crop-production and variation and underlying the development, type and extent of various industries attendant on agricultural development will be discussed.

Dot maps showing the acreages under the more important crops in 1930 have been prepared from data supplied by the Ministry of Agriculture. The maps are based on the Petty Sessional Divisions of the region. Accurate representation of crop distribution is impossible in a region of such diverse topography, geology and consequent land utilisation and where, as a result each division often includes varying types of country. Although a greater degree of accuracy is probably possible if data for each parish instead of for the larger Petty Sessional Division is shown, yet the same disability would be present as most of the parishes are strip-shaped and include bits of various types of country. In constructing the maps the presentation of distribution within each area has been slightly influenced by personal observation and knowledge of land utilisation in the areas, in order to obtain a greater degree of accurate presentation.

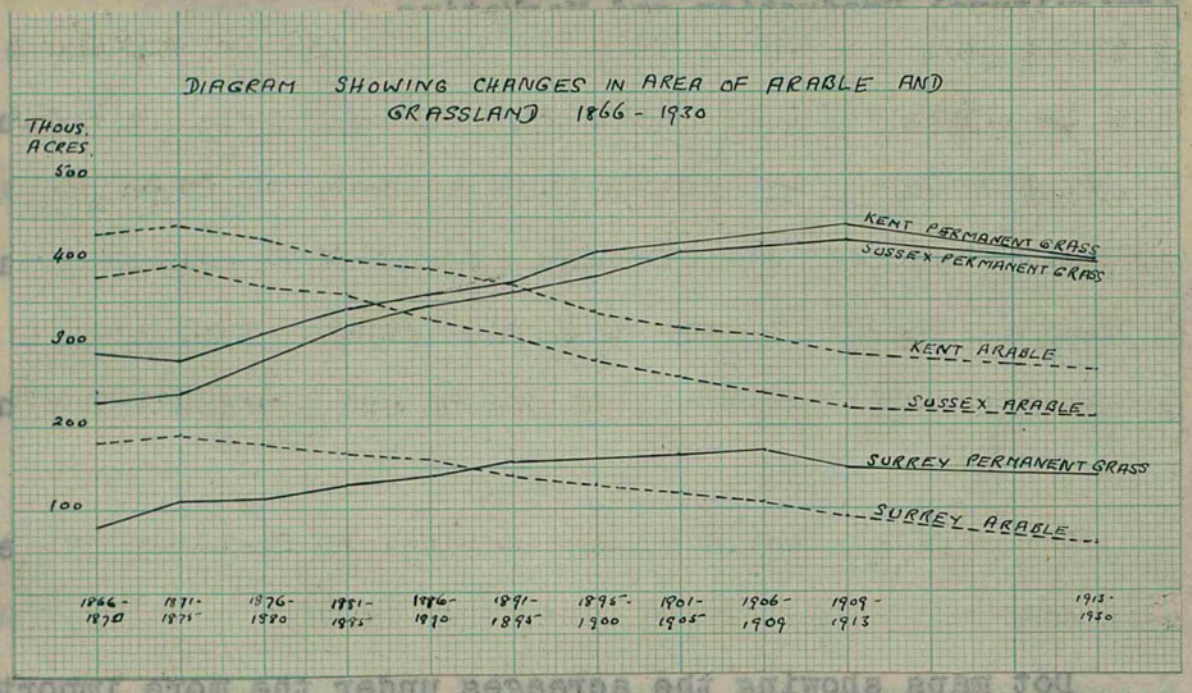


Fig.67.

Note (a) The steady decrease of arable land, less marked of recent years in Kent than in Sussex and Surrey.

(b) The general decline in Permanent Grassland has been accompanied by a general increase in Rough Grazing land.

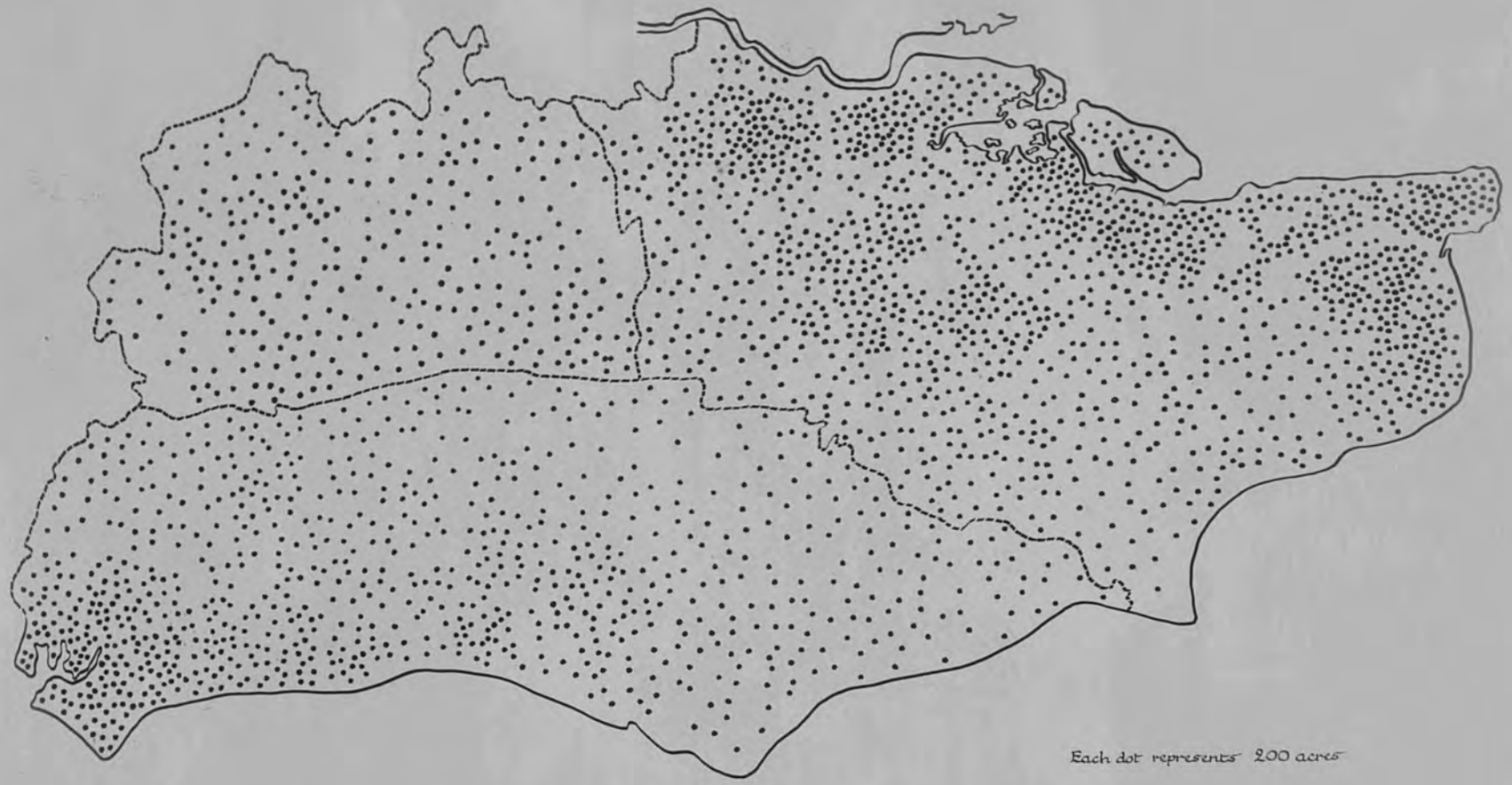
A further set of maps compares present and pre-war crop distribution, and shows both the actual and percentage variation in acreage within each division. The year 1913 was selected as being typical in most respects of immediate pre-war conditions and a comparison of 1913 with 1930 is calculated to show a general picture of agricultural trends unaffected by abnormal conditions obtaining during and immediately after the war.

The general change in the balance of grassland and arable land over a long period is shown in Fig.67.

Kent, where arable farming assumes a greater importance than in Surrey or Sussex shows the least decline in arable land. The distribution or arable land, and the percentage it forms of the total cultivated land is shown in Figs 68 and 69[1]. The four areas where arable farming assumes major importance are the North Kent region, the Mid Kent region, the Sussex maritime plain and the East Kent region. The superior conditions of soil and climate which has resulted in this form of land utilisation have already been discussed. In the Isle of Thanet 73·6% of the total cultivated land is arable and in the Dartford division 67·9%.

Fig.70 shows the variation in arable acreage during 1913-1930. The decrease is most marked in regions of urban expansion (e.g. in N.E. Surrey and Thanet) and in the Downland and heavy weald clay areas of Sussex and South Surrey. In Kent

(1) For figures relating to acreages of arable land, grassland and various crops and for the variations in their acreage, see Appendix Tables 10 and 11.

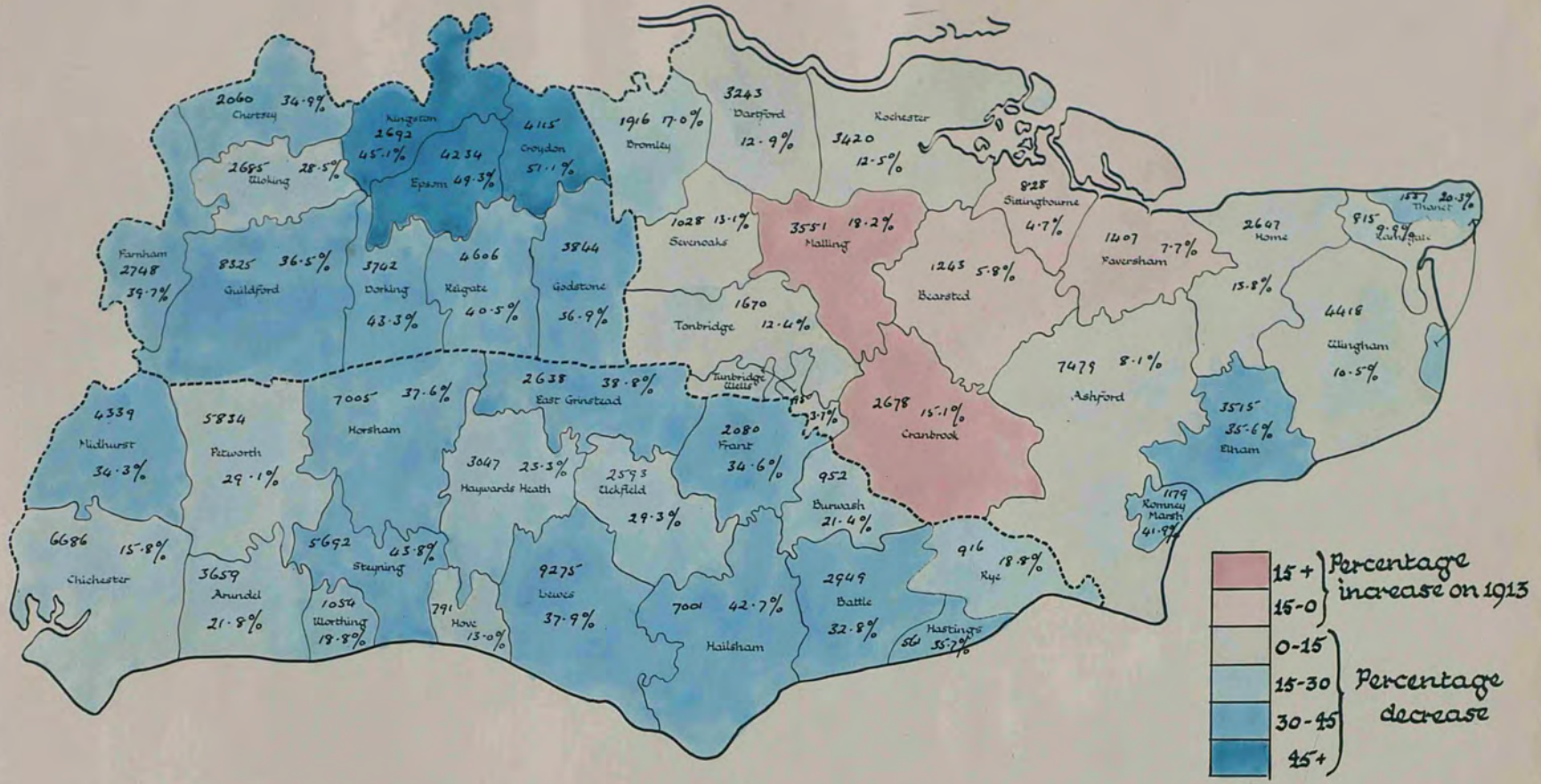


DISTRIBUTION OF ARABLE LAND

Fig.68. Note (a) The importance of arable land in N.E. Kent and S.W.Sussex and in the Medway Valley.
(b) Small amount of arable land in the central Wealden area.

PERCENTAGE OF TOTAL CULTIVATED LAND FORMED BY ARABLE LAND

Fig.69. Note (a) Very high percentage of arable land in N.and E.Kent and in S.W.Sussex.
(b) Low percentage throughout the Wealden area and the marshlands.



VARIATION IN ARABLE ACREAGE 1913-1930

Fig.70. Note (a) Increase in arable acreage throughout the fruit-growing regions of Kent.
(b) General decrease elsewhere.

DISTRIBUTION OF PERMANENT GRASSLAND

Fig.71. Note the general density throughout the Wealden area.

the decrease has not been general. Areas where arable acreage is already high show in some cases an increase and there is an interesting spread of arable acreage into the High Weald region of Cranbrook, mainly connected with the extension of fruit-farming. The variety of the soils of the High Weald has already been described and the difficulty of working them in areas where they form heavy silt loams with many of the properties of clay soils has hindered their utilisation. "The potentialities of these Hastings Beds both for mixed farming and, in some cases, for fruit farming are not yet fully appreciated."[1]

The distribution of permanent grassland (Fig.71) shows the prevalence of grassland throughout the Weald, except in the forest region of the High Weald. In the Downland areas much of the open sheepwalk is returned as rough grazing and is not shown on this map. In Sussex there has been a big increase in grassland, especially in the heavy lands of the East Grinstead, Horsham, Petworth area, but in Kent and Surrey there has been a slight decrease in most areas. In the Wingham-Elham area, much of the chalk loam land previously used for cereal production has gone down to grass, but in North Kent generally the light rainfall and light soils do not favour good pasture growth. The arable lands of SW. Sussex, by contrast, show an increase of grass acreage. The heavier

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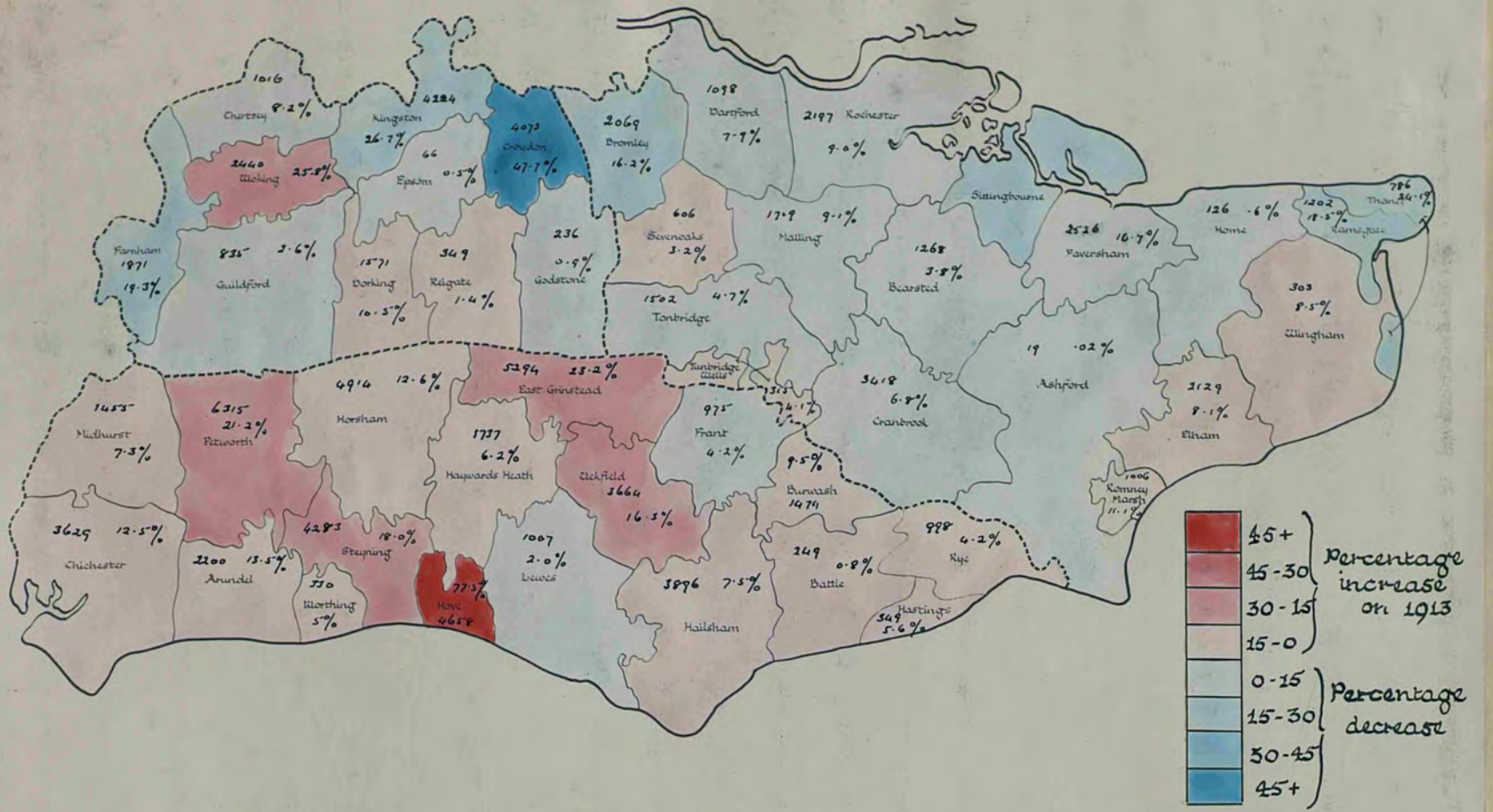
(1) Extract from a report on Agriculture in Sussex by the County Director of Agriculture.

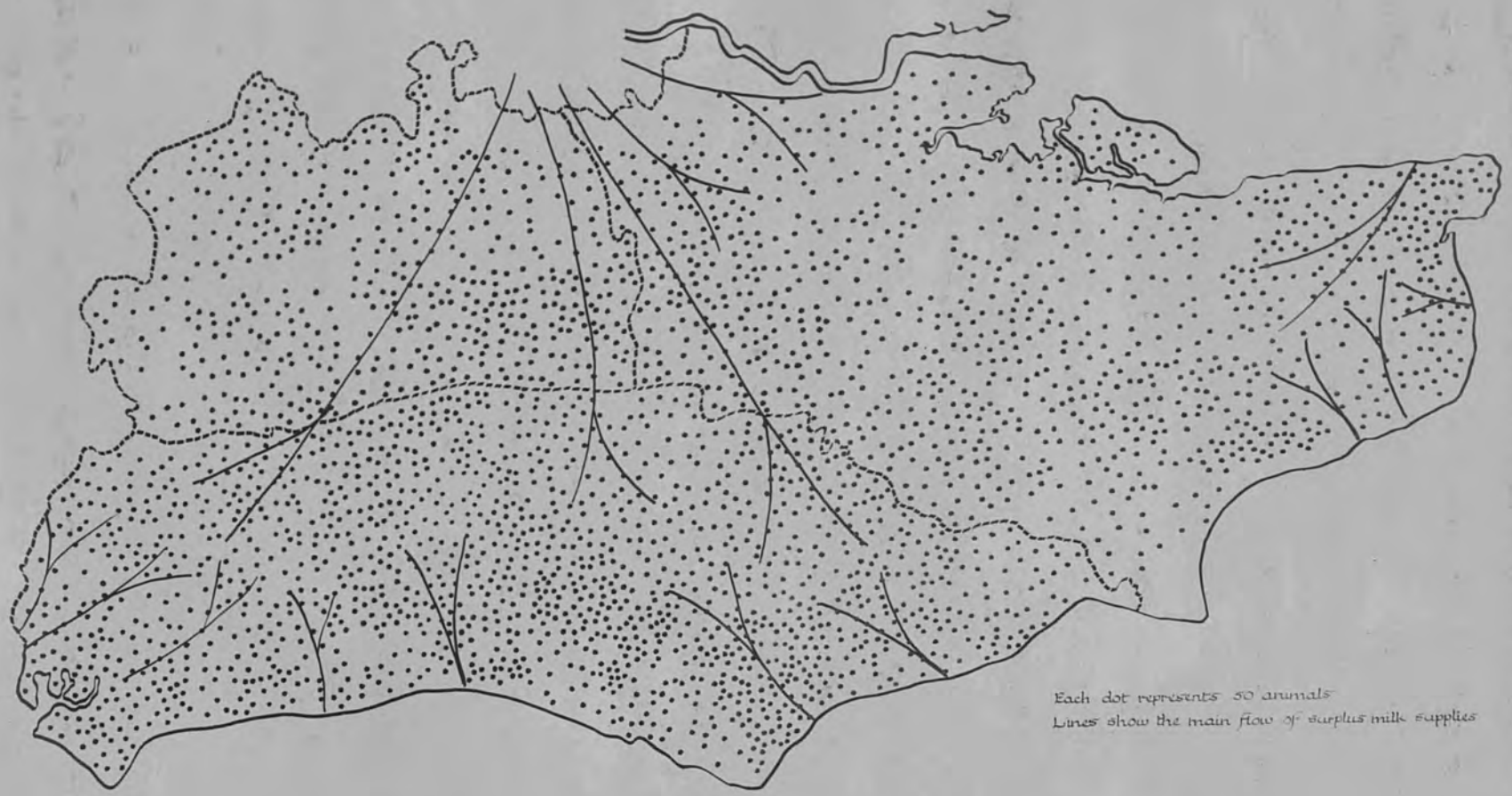


VARIATION IN TOTAL GRASSLAND ACREAGE 1913-1930

Fig.72. N.B. For purposes of greater comparability, Rough Grazing has been included with permanent grass. (see Note 4 to Table 11 of Appendix.)

rainfall has always favoured a considerable amount of pasturage in this area, and the acreage is being extended.

The greatest change in South country farming generally has occurred in the stock industries. Sussex farming was formerly concerned with the production of corn, beef and sheep; in Kent, with the exception of fruit, hop and market garden crops, corn and sheep were the major concern of the farmer and in Surrey a similar state of affairs obtained. Dairy farming - a growth of the last half-century, is now the major concern of most farmers. More Sussex farmers depend on the output from their dairy herd than on anything else and in Surrey farming has become almost entirely subordinated to milk production. The growth of the dairy-industry in the S.E. has differed from the growth in more purely rural areas where it has been forced on the farmer by world competition in the production of corn and meat. Although these influences have undoubtedly been felt - especially during the last decade, in S.E. England, dairy farming here has been a much more natural growth due to the direct stimulus of growing local markets. In Surrey local markets now dominate agricultural practice. It is a county of a big, and on the whole wealthy, residential population unconcentrated into towns except in the suburban area, and the prevailing type of farm management, irrespective of soils is the small holding with milk cows. Hay is grown for fodder, but few roots, because



DISTRIBUTION OF DAIRY CATTLE AND MOVEMENT OF MILK

Fig.73. Note (a) The density of dairy cattle in Sussex.
(b) The movement of milk from Sussex to London.
(c) The absence of any but local markets in Surrey and in most of Kent.

farmers are so well situated for the import of feed-stuffs from London. Transport rates within a 30 mile radius of London are very low and loads of sugar beet pulp from the refineries of E. London, of grain and hop waste from local and London breweries and even cargoes of stuff like cocoa which has been pronounced unfit for human consumption, are bought for cattle feed. All the milk produced is sold locally and in most cases the farmer is sufficiently near his market to act as producer retailer. Where the milk is sold through a middleman, the farmer can often force him to pay more than wholesale prices by the threat of competition.

Dairy cattle assume their greatest importance within the region in Sussex and especially in East Sussex (Fig.73).

The rearing of Sussex cattle and the production of beef was formerly the most important branch of Sussex agriculture. The cattle were bred on the Wealden farms and fattened on the rich marsh districts. With the fall in meat prices and the growth of the dairying industry this practice is rapidly declining and the resulting understocking of Pevensey Levels is causing a rapid deterioration in the marsh pastures. Shorthorns and other dairy breeds have largely displaced Sussex cattle[1].

Dairying is naturally more concentrated round the towns and is practised alike on the large Downland farms and on the

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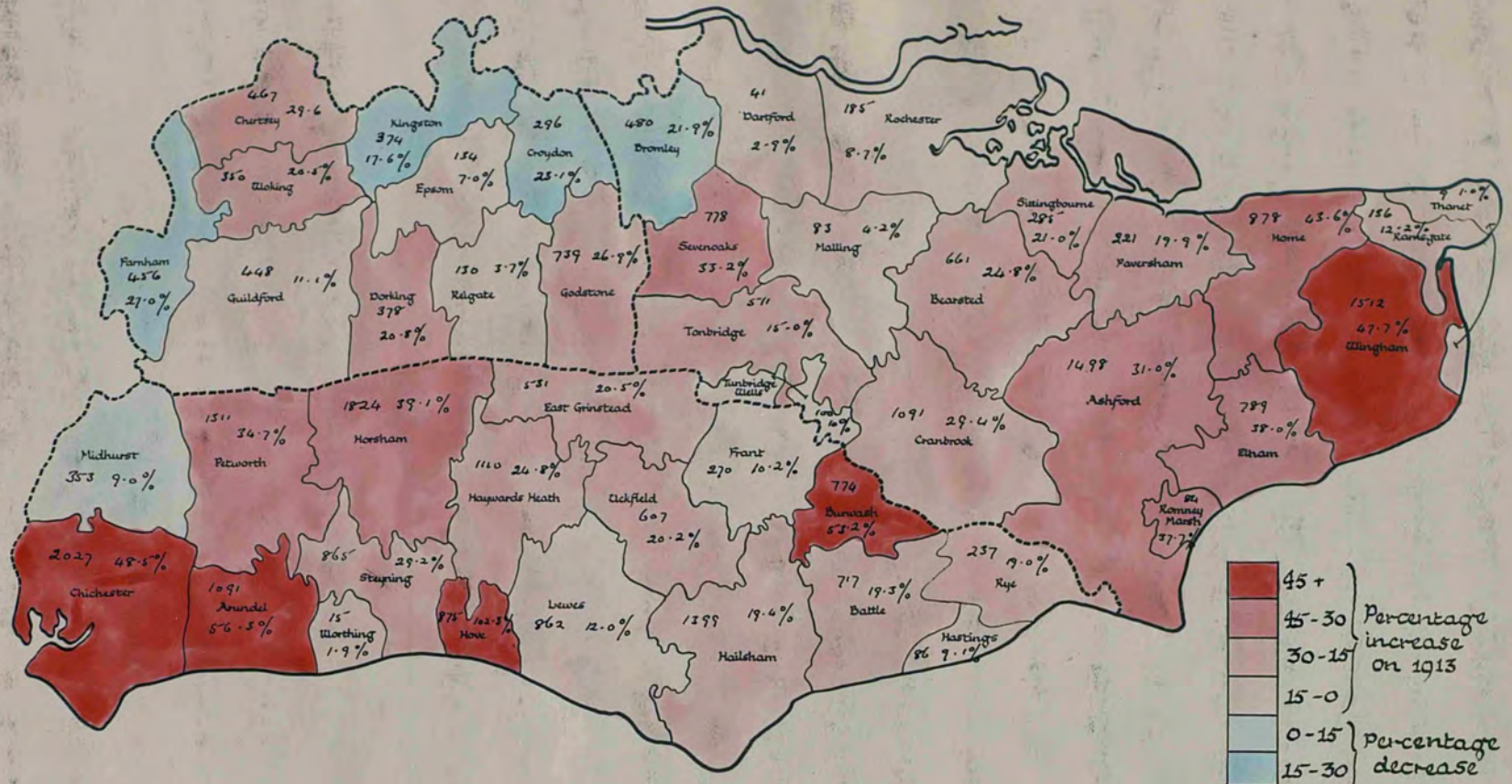
(1) For Figures of Head of Stock etc. see Appendix Table 10.



VARIATION IN HEAD OF DAIRY CATTLE 1913-1930

Fig.74. Note (a) Big and widespread increase.
(b) Greatest increase, both relative and absolute in E.Kent and W.Sussex.

small farms of the Weald. The industry is less intimately connected with its markets than in Surrey. The main markets are the South Coast watering places, the Portsmouth urban area and the London area. The first two take together about two-thirds of the total production and London about one-third, but the relative importance of the market varies with the season, more emphasis attaching to the South Coast market in summer where there is both an augmented demand and a greater desire on the part of retailers for local milk because of its superior keeping qualities.

The biggest growth, both actual and relative, in the dairying industry is shown in W.Sussex (see Fig.74) and in especial in the maritime plain region. The arable land of this area is largely under roots and corn for feed-stuffs, and although everywhere there has been a big decrease in the acreage under roots and other fodder crops, the presence of cheap, locally produced feeding stuffs has greatly benefited dairying.

Dairying is said to be having a deteriorating effect on the Weald Clay lands. "The dairying is greatly damaging the farms, but the tenants live and pay their rents: but soon this clay land will be unproductive."[1]

In Kent while the total head of dairy cattle is only slightly in excess of that in E.Sussex alone, the increase in

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(1) Messer "The Agricultural Depression of 1931", p.30.

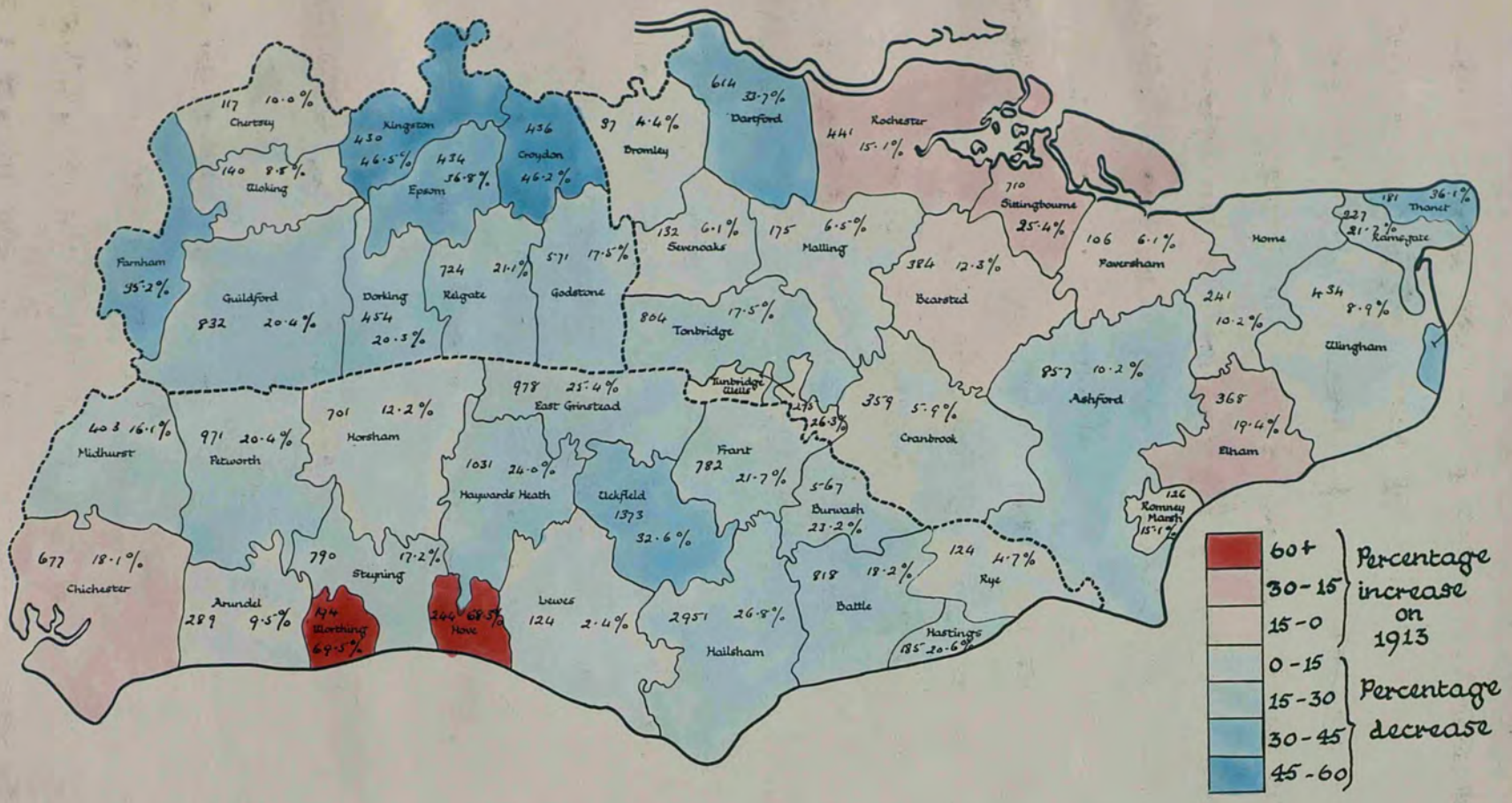
DISTRIBUTION OF CATTLE OTHER THAN DAIRY CATTLE AND MARKETS HANDLING MORE THAN 5000 HEAD OF STOCK (OF ALL TYPES) PER ANNUM

Fig.75. Note (a) Foremost position of Sussex, where density is concentrated on Pevensey Levels and the Low Weald.
(b) The location of markets along this belt. Their scattered location elsewhere.

dairying has been even more marked and especially in those areas well placed to serve the coastal urban centres. On the marsh-lands of E. Kent dairy cattle have largely displaced beef cattle. Kent, however, produces no surplus milk and the amount drawn into the London area from N.Kent has to be made good by imports, mainly from Sussex.

While showing a big decline in numbers, Sussex is still the most important region for the production of store cattle. The decline is not entirely general. In the Kent fruit region where it is the general practice to stock fruit farms with bullocks and sheep for meat, there has been a slight increase in numbers. The pure-bred Sussex cattle are largely displaced by Sussex crossed with Shorthorn, except in certain Low Weald areas, where the Sussex retains its popularity owing to its extreme hardiness on wet clay soils.

The sheep industry illustrates further change in the stock industries. Fig.77 which shows the summer distribution of sheep, indicates the strong concentration of sheep in Kent and in especial, on Romney Marsh. The region is noted for two breeds of sheep, the Romney Marsh and the Southdown, and of these, the Romney Marsh is to-day by far the more important, and plays an important part in farm economy throughout the region. The breed is noted for its hardiness which is due to only those ewes being kept which are sufficiently hardy to



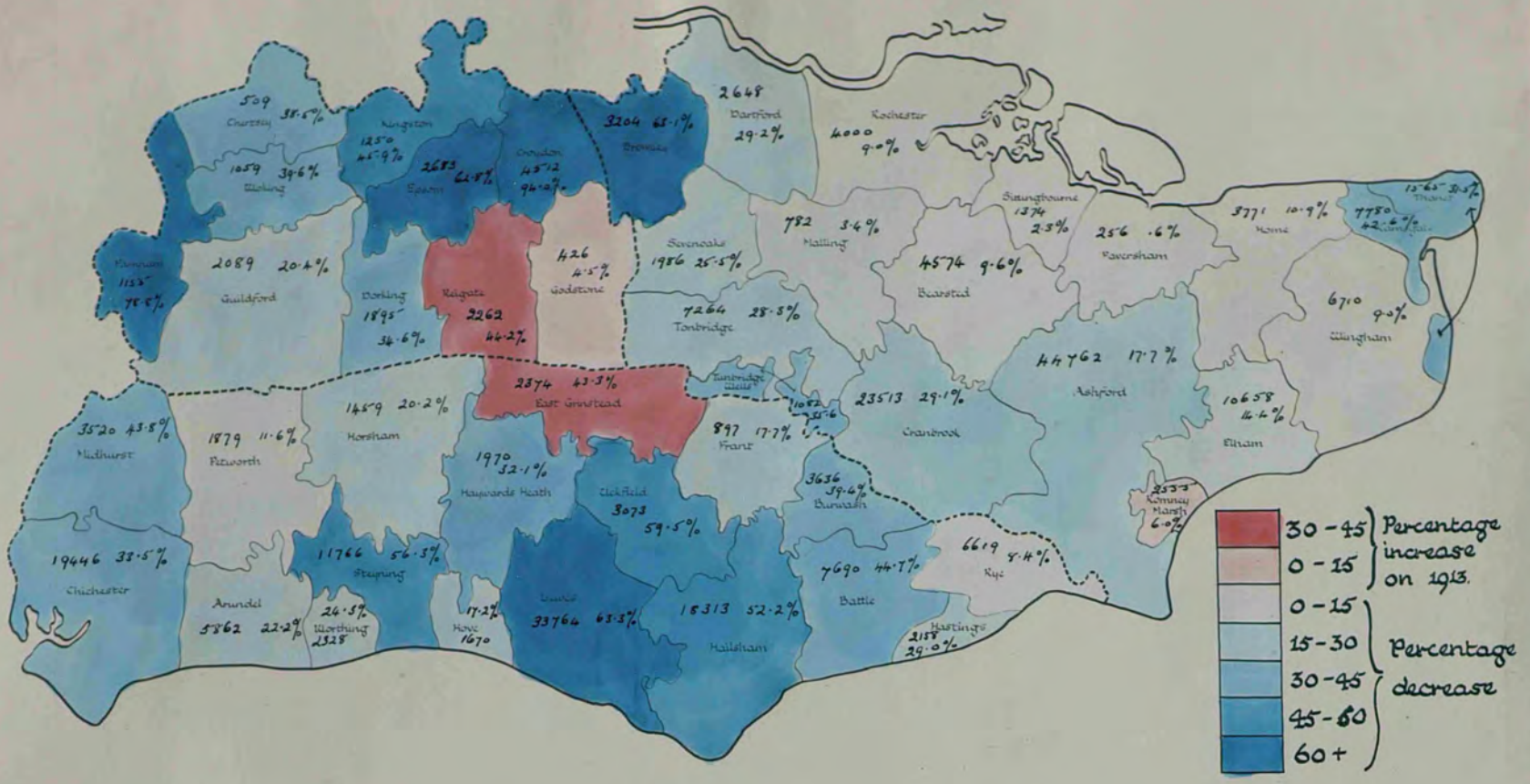
VARIATION IN HEAD OF CATTLE OTHER THAN DAIRY 1913-1930

Fig.76. Note (a) General decrease especially marked in areas carrying a large head of stock and in areas near great urban development.
(b) Increase in fruit growing regions.

withstand the winter on grass-feeding alone. In early spring the Romney Marsh graziers stock their marshes very heavily. Towards the end of the summer the lambs, unable to winter on the cold wet marshes, are sold in their hundreds at the various fairs and special sales held on the fringes of the region. Large numbers are bought by the Wealden farmers, and by the fruit farmers of N.Kent, especially of the Sittingbourne and Faversham district where they graze the grass cherry orchards. The small Weald farms carry about one lamb to the acre and through the winter they receive no feeding other than grass, returning to the fatting pastures of the Marsh in the following spring. The importance and numbers of these grass-land sheep has been fairly maintained. They are hardy, not costly to the farmer and fit in well with farming economy (the soil of the Low Weald is too heavy to carry cattle in winter). Romney Marsh sheep have been used to an increasing degree to stock the areas going down to grass on the heavy lands of South Surrey and North Sussex and in the Midland and Eastern Counties.

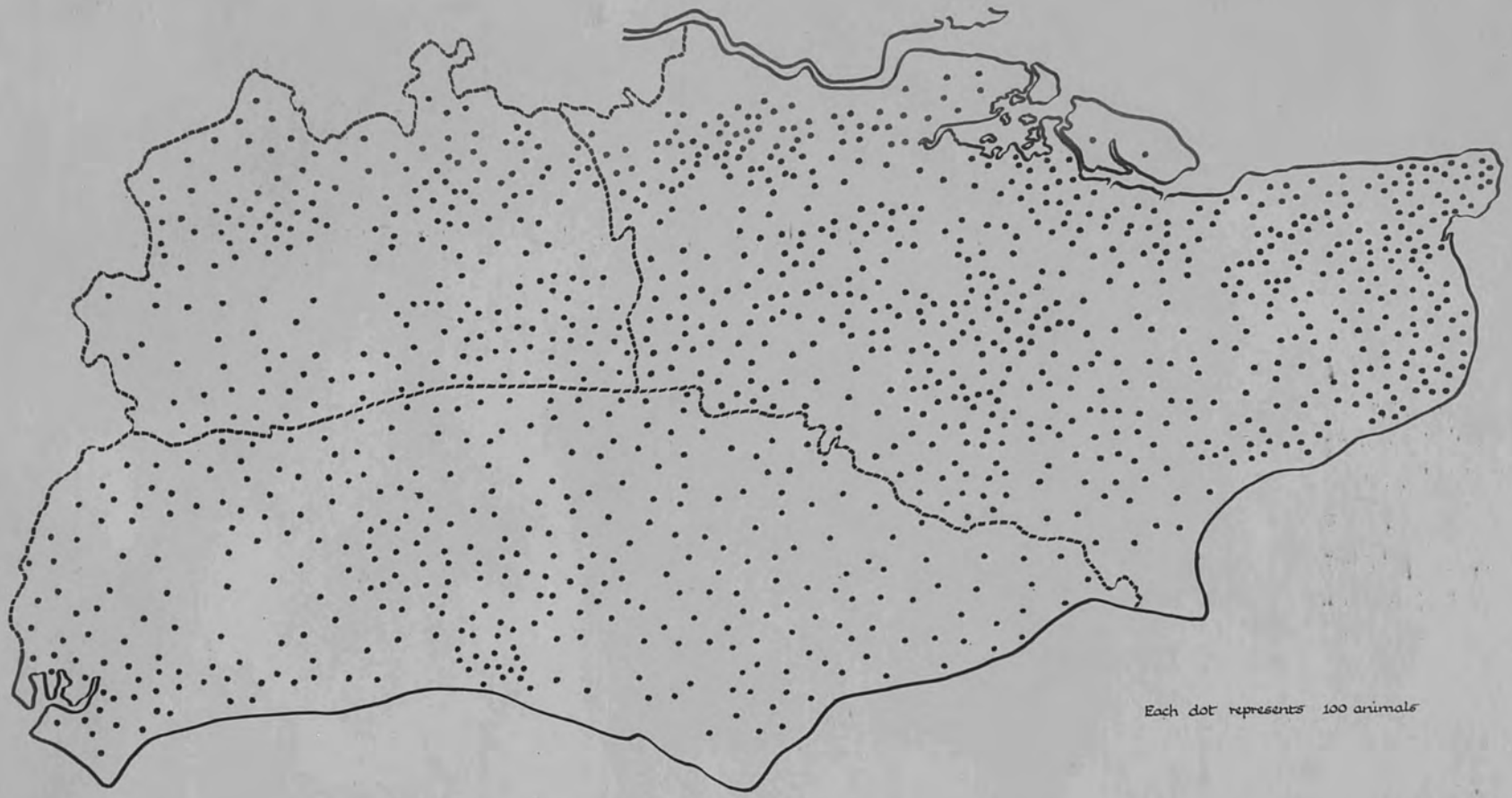
There is, in addition, a steady export of pedigree stock to the new stock-rearing counties.

The position is very different in the case of South Down sheep. This is a breed that makes big demands on labour; it is not very hardy and has been bred so exclusively for mutton without regard to breeding capacity that it has become too



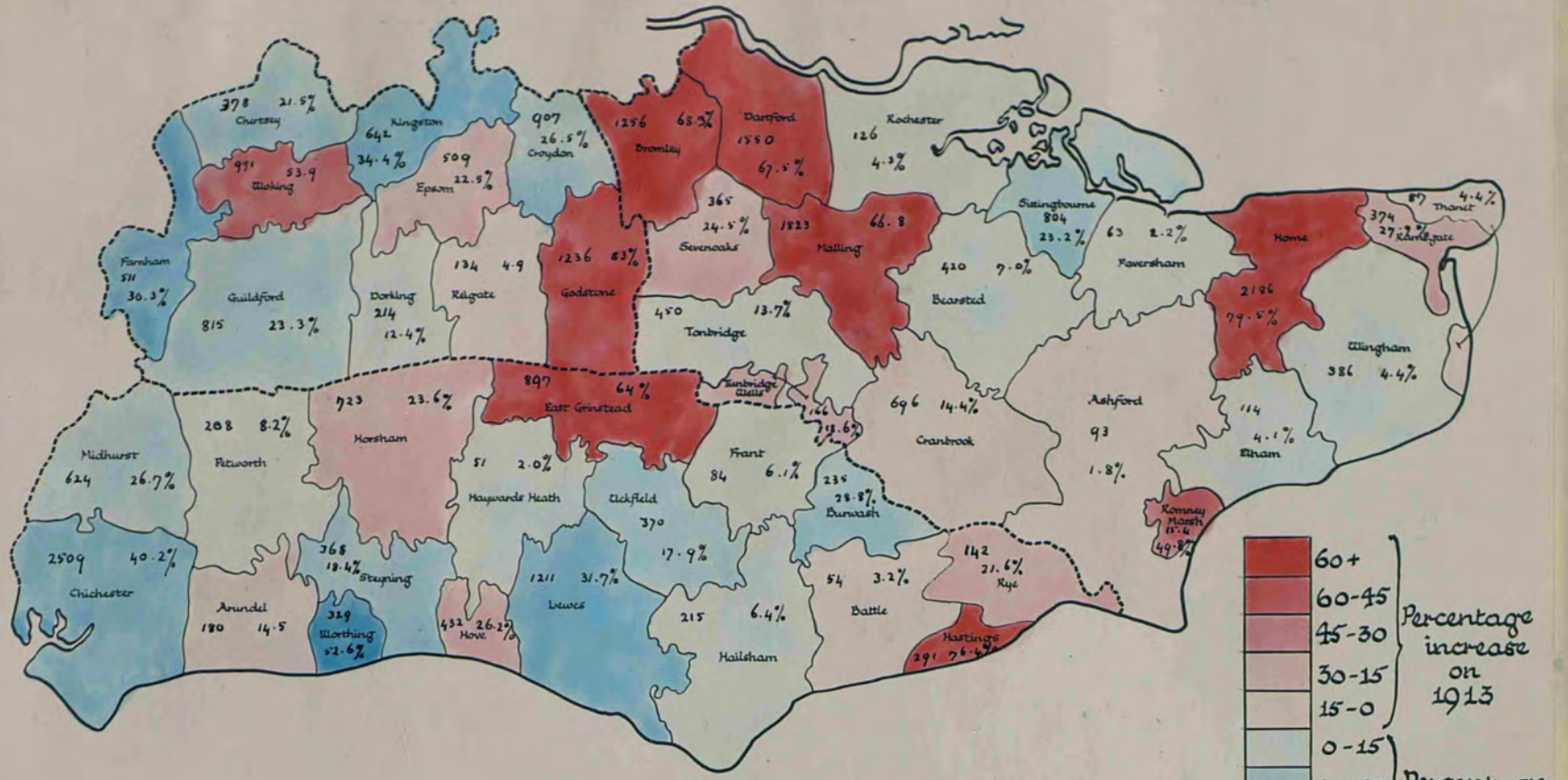
VARIATION IN HEAD OF SHEEP 1913 - 1930

Fig.78. Note (a) Large decrease (1) in areas of urban development
(2) in S.Downs region.
(b) Relative increase in certain Wealden areas.
Absolutely this is not very important.



DISTRIBUTION OF PIGS

Fig.79. Generally widespread and not very dense distribution.



VARIATION IN HEAD OF PIGS 1913-1930

Fig.80. Note: Marked increase generally confined to vicinity of urban centres.

DISTRIBUTION OF MANGOLDS

Fig.81. Note: Distribution generally widespread, with slight emphasis on leading arable areas.

DISTRIBUTION OF TURNIPS AND SWEDES

Fig.82. N.B. Heavy concentration on light soils of East Kent and of Chichester region, i.e., on the main cereal regions.

Fig.83. Note: The importance of lucerne as a fodder crop on the area of light soils and low rainfall of North Kent.

VARIATION IN ROOTS ACREAGE 1913-1930

Fig.84. N.B. The general decrease in fodder crop acreages is to be associated with the general decrease in arable acreage and head of sheep etc. Roots show a greater decrease in this connection than other fodder crops. See Fig.85.

VARIATION IN FODDER CROP ACREAGE (OTHER THAN ROOTS) 1913 – 1930

Fig.85. Note: General and widespread decrease.

the product. In 1920, the Kent Wool Growers Ltd.[1] was formed for the cooperative marketing of wool and this association handles about two-fifths (200,000) of the total Kent fleeces. This wool is sold on the London market and as much as 50% of it may be for export. Cooperative marketing of wool has proved advantageous as is usual in a product for which there is no local market. In Sussex a wool cooperative society has also been organised at Chichester but its operations are as yet small scale. Much wool is still sold by private treaty.

Pig keeping has never been very important in the S.E. The distribution of pigs is fairly general and shows a certain concentration near urban centres (e.g. in Hove region) and in N.Kent, where they are largely kept in orchards. Their density throughout Kent is greater than in Surrey and Sussex.

Pig-keeping has generally decreased in Surrey and Sussex and the numbers have become more concentrated near the larger towns where cheap food and in form of swill, waste bread etc., is easily available. In Kent this tendency is especially marked and accompanied by a general increase throughout the county. (see Figs. 79 and 80).

A list of the main livestock markets is shown in Table 24. There is a total of 26 markets in Kent, 22 in Sussex and 9 in Surrey, but of these only 15, 9 and 2

Table 24.

The Main Live Stock Markets of Kent, Surrey and Sussex arranged according to the total head of stock passing through each during a recent typical year.

Market Towns	Frequency	Cattle	Calves	Sheep & Lambs	Pigs	Total
Ashford	Weekly	5140	6180	99840	31930	143090
Maidstone	"	4500	2420	38800	20000	65720
Canterbury	Weekly (Store)					
	Fortnightly (Fat)	5350	2380	40000	16700	64430
Chichester	Fortnightly	15040	5500	28430	8450	57420
Lewes	Weekly	5350	7420	10790	14500	56200
Guildford	Weekly	6750	5760	16280	26630	55420
			3690	30000	8500	
Rye	Fortnightly	1600	720	51200	1350	54870
Barnham	Weekly	4300				46520
Sandwich	Fortnightly	3340	2210	22410	17370	45330
Lyminge	Weekly	2200	800	34600	4000	41600
Tonbridge	"	4460	3020	18550	10970	37000
Rochester	"	3040	1350	20810	9050	34250
Steyning	(Weekly (Fat)	4000	4430	10380	8500	27310
	(Fortnightly (Store)					
Ham Street	2 or 3 times annually	740	10		24900	25870
Sittingbourne	Fortnightly	1870	650	12000	10750	25270
Kingston-on-Thames	Weekly	810	2500	1650	12000	16960
Sevenoaks	"	1700	3000	7000	5000	16700
E. Grinstead	"	2480	2800	3650	6890	15820
Haywards Heath	"	3000	3500	2700	6000	15200
Hythe	5 times annually	320	-	14260	-	14580
Staplehurst	Fortnightly	600	800	4500	7800	13700

Table 24 (contd)

Market Towns	Frequency	Cattle	Calves	Sheep & Lambs	Pigs	Total
Northiam	Fortnightly	1200	500	10690	660	13350
Edenbridge	Weekly	3600	700	8600	150	13050
Headcorn	"	740	-	10100	-	10840
Hailsham	Fortnightly	2460	2930	1800	3400	10590
Gillingham	"	660	7500	320	1530	10010

From "Markets and Fairs" in England and Wales. Min. of Agric. & Fish, 1929.

TABLE XXV.

Nine Fair Centres in Kent, Surrey and Sussex arranged according to approximate number of livestock offered annually.

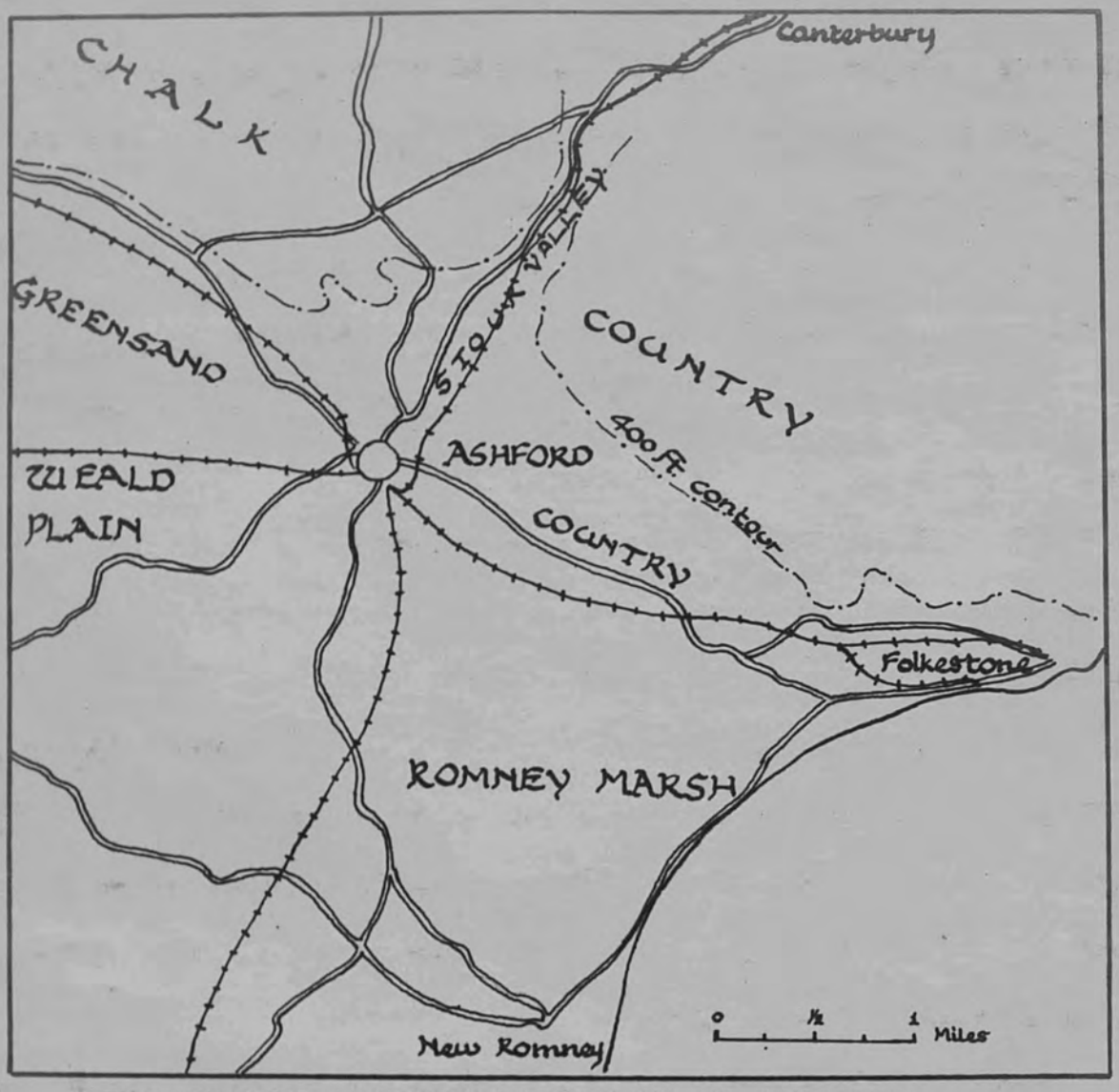
Fair	Total Cattle	Total Sheep	Total Livestock
Maidstone	2,600	17,860	20,460
Tenterden	1,000	18,000	19,000
Lewes	450	18,320	18,770
Feadon	-	15,000	15,000
Ham Street	-	11,000	11,000
Horsmonden	-	10,000	10,000
New Romney	-	10,000	10,000
Northiam	450	7,000	7,450
Biddenden	2,000	4,000	6,000

respectively handle more than 10,000 head of stock in a recent typical year.

Ashford is by far the most important. The number of stock handled there is surpassed only by Norwich in all the Eastern and Southern counties. Sheep predominate but considerable quantities of cattle and pigs are also sold. The importance of Ashford as a market is due to its position at the meeting point of differing types of agricultural land; to easy and direct communication in all directions; and to local topographic conditions allowing for good marketing facilities.

It lies where the Chalk lands, the Greensand lands, the Romney Marsh and Weald Plain converge, and by the line of the Stour valley to the N. gives easy direct access to the E. and N. Kent regions (see Fig.86). Road and rail spread out in all directions and though supplies of livestock are drawn chiefly from the good agricultural district which lies within a twenty-mile radius round the town, good railway facilities cause an appreciable quantity of fat cattle to arrive from outside the radius, from Norfolk and Sussex. At the special sales in Spring and Autumn buyers attend from distant counties and as many as 65% of the store lambs offered go outside the twenty-mile radius.

The market lies about $\frac{1}{4}$ mile from the centre of the town, adjoining the railway, to which it is connected by a siding.



SKETCH MAP SHOWING LOCATION OF ASHFORD

Fig.86.

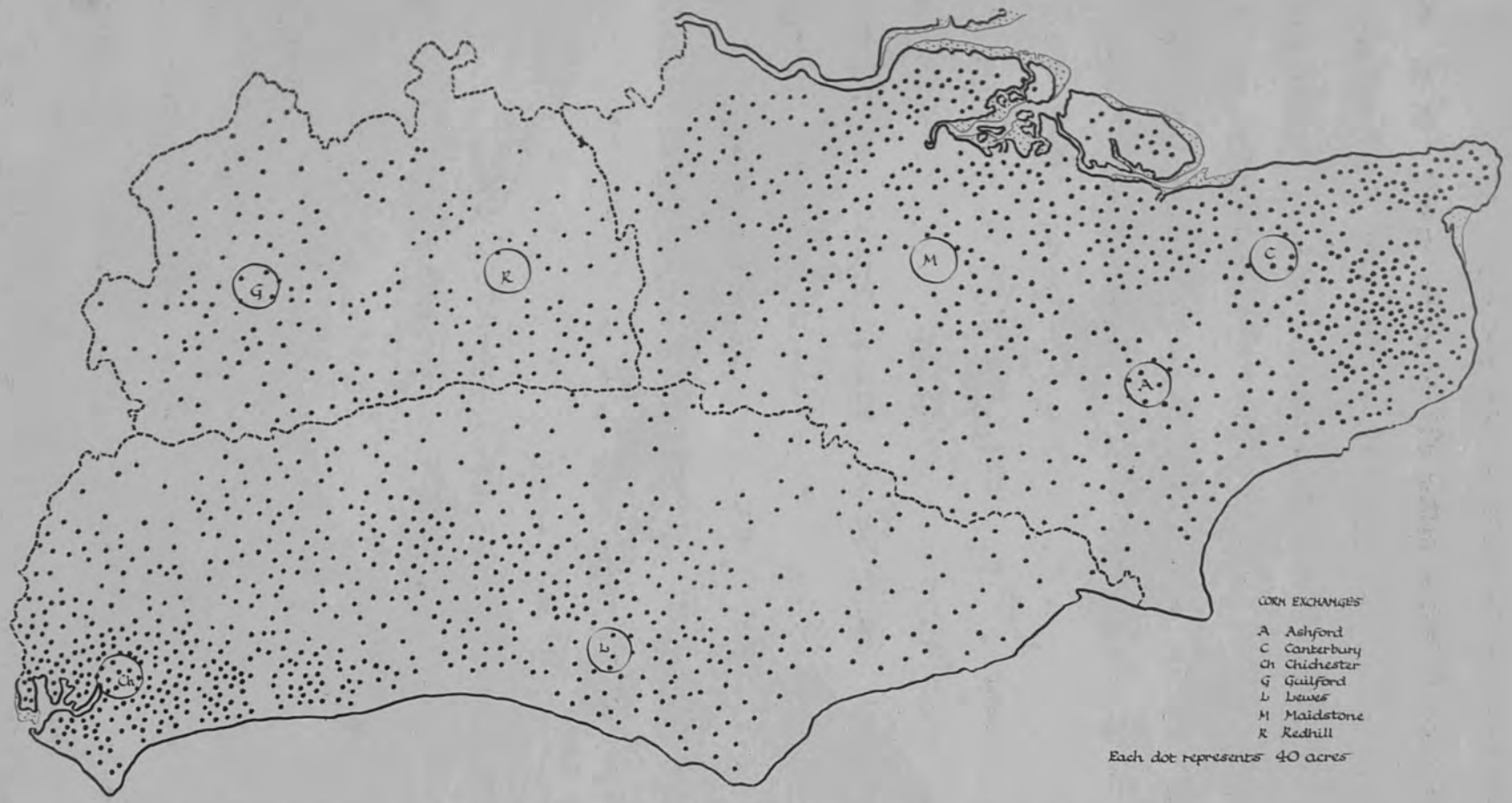
Note (a) Situation of Ashford at meeting point of different types of country.
(b) Radial arrangement of routes centring on the town.

The flat topography allows the market to spread, roadways are wide and as a result, congestion common to livestock markets is reduced to a minimum.

Maidstone and Canterbury, far less important than Ashford, are concerned more immediately with local supplies. Both are focal points in prosperous agricultural districts and, as such, form natural centres for marketing. They lack, however, the complete nodality of Ashford, its superior local conditions, and above all its close connection with the Romney Marsh grazing grounds. Canterbury and Sandwich, near the rich pastures of the Lower Stour, are the most important markets for fat cattle, the locally produced supplies being sold to the seaside towns. Maidstone is concerned rather with the sale of store cattle and sheep, at special sales in Spring and late Summer.

The most important cattle market is at Chichester, the centre of an arable region devoted on the whole to root and cereal production. It is very largely a collecting and distributing centre for store cattle from the W. of England, and from Chichester cattle are sent to various Southern, Eastern and Midland counties for feeding and dairying purposes.

The seasonal nature of sheep marketing has resulted in the establishment of sheep fairs near areas of concentrated sheep breeding. Some of these fairs are of ancient origin and



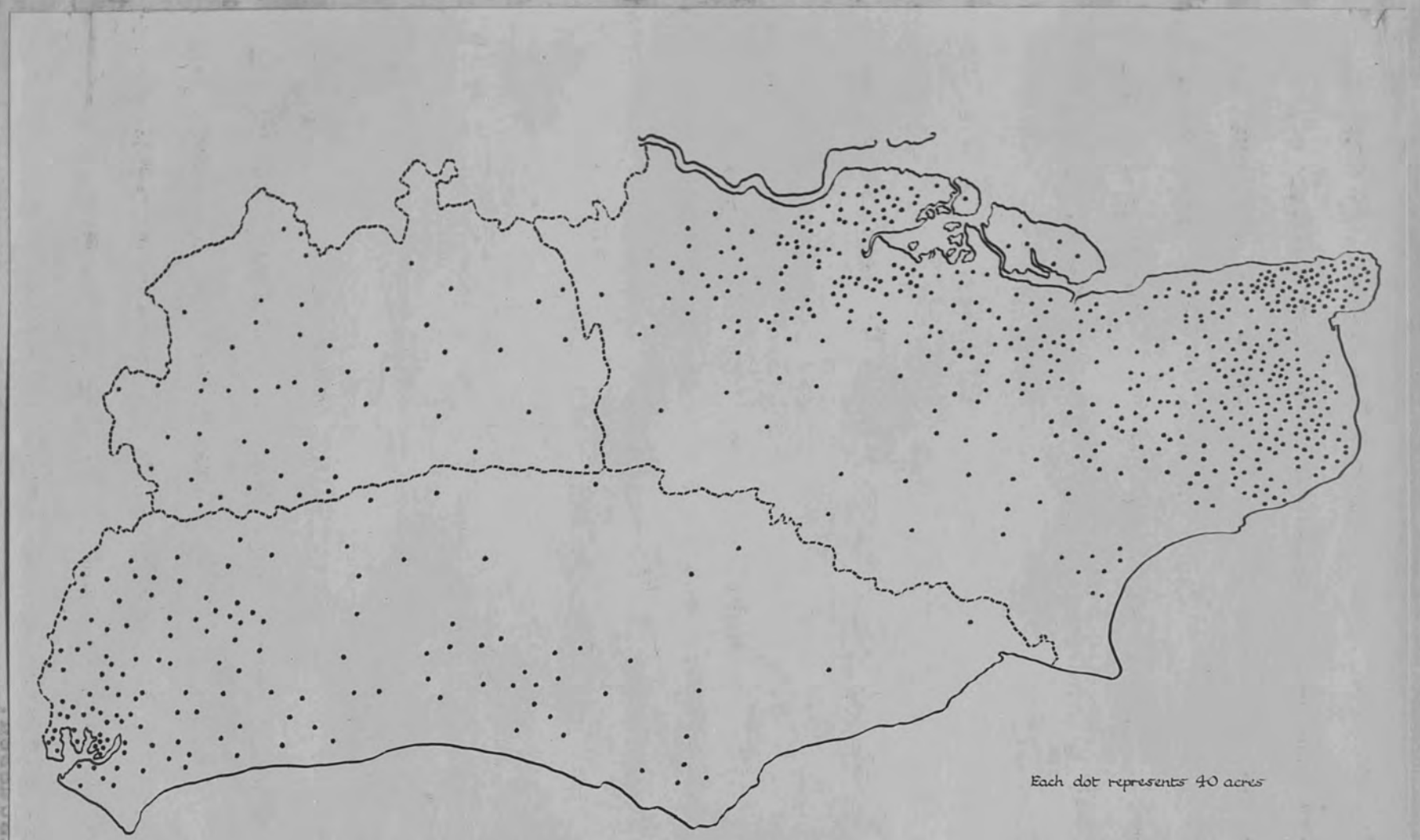
DISTRIBUTION OF WHEAT AND CORN EXCHANGES HANDLING MORE THAN 15,000 CWTS PER ANNUM

Fig.87. Note: (a) Concentration of wheat production on E.Kent and S.W.Sussex.
(b) Location of main corn exchanges in principal market towns, not always in a centre of wheat production.

their persistence is in some cases merely due to local tradition and has little connection with sheep, e.g. the Kingston fair. They may take place in towns which have no market, e.g. at Findon and Horsmonden, while others occur at market towns, as at Maidstone, though frequently not in the regular market owing to lack of space. A list of the principal fairs is given in Table XXV. together with the amount of sheep they deal with in an average year. With the exception of the Maidstone fair, which is held four times a year and which therefore does not represent an equivalent concentration of stock as most of the others which are annual or twice-yearly, these fairs fringe the Marsh grazing grounds in Kent and Sussex or the Chalk Downlands in Sussex. The most important Kent fairs are at Maidstone, Tenterden, Ham Street, Horsmonden, and New Romney, and are concerned with the sale of Romney Marsh sheep while at Lewes and Findon there are sales of South Down sheep once and twice yearly.

Figs. 87, 88 and 89 show the distribution of the main cereal crops. Oats show the most general distribution with a certain concentration on the arable lands of S.W.Sussex and E.Kent. Wheat, with a smaller total acreage shows a similar concentration while barley is almost wholly confined to N. and E.Kent with an especially marked concentration in Thanet[1].

(1) The climatic control of barley production has already been discussed.



DISTRIBUTION OF BARLEY

Fig.88. Note: Barley Production almost confined to the light soils and drier climate of E. and N.Kent.

Barley production was once of great importance in the Isle of Grain, but has been supplanted by market-gardening.

The varied physiography of the region affects not only corn distribution but yields per acre. While variations from region to region and often from field to field within the same farm, are considerable, the following table indicates general conditions.

TABLE XXVI.

Corn yields in S.E. England and in England and Wales. Average 1921-1930.*

	Wheat	Barley	Oats
Kent	19·3 cwt	17·3 cwt	17·3 cwt
Surrey	15·4	12·9	12·7
E.Sussex	16·8	13·5	13·8
W.Sussex	17·3	14·1	14·1
England & Wales	17·7	15·5	14·7

The general superiority of the drier Kent cornlands is marked. In wheat yields, only the Isle of Ely, the Holland area of Lincolnshire and the Peterborough region show a higher figure and for barley, the Kentish yields are surpassed only by the first two regions and by Cornwall. In Surrey and Sussex yields per acre are comparatively low.

(*) From "Agricultural Statistics for England and Wales." (Min.of Ag.)

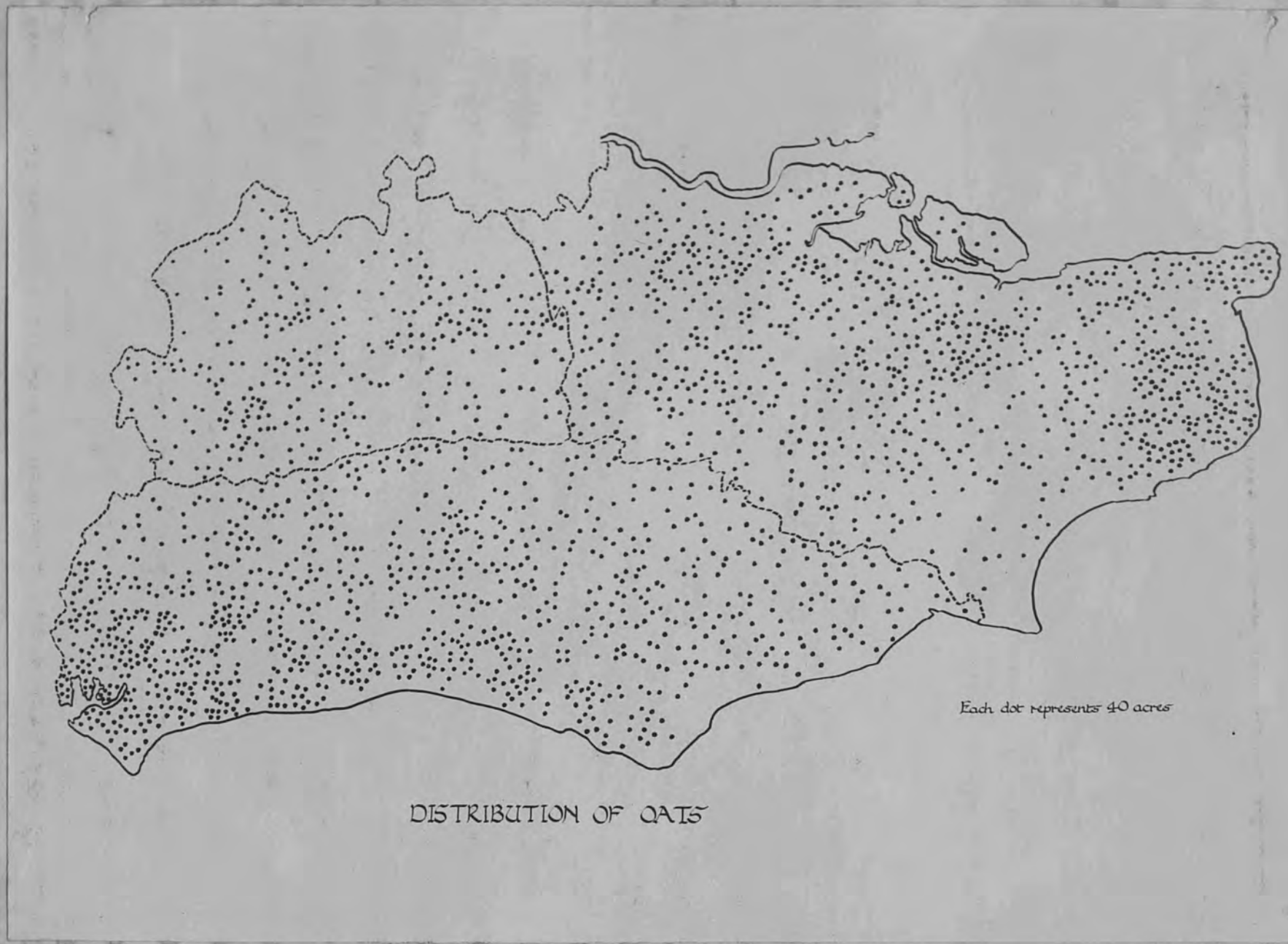


Fig.89. Note: More general spread of oats than of wheat and barley.

Fig.90 shows the general diminution of cereal acreage, and the loss for each corn crop is listed in the following table.

TABLE XXVII.

	Wheat		Barley		Oats	
	Acreage loss	% loss	Acreage loss	% loss	Acreage loss	% loss
Kent	17858	37·7	9843	32·3	9118	20·9
Surrey	7719	48·4	2724	58·8	7377	37·5
E.Sussex	8700	44·3	746	37·2	7898	31·9
W.Sussex	9937	36·3	1053	19·0	9613	31·7

The biggest decrease has occurred in the wheat acreage. This reflects conditions throughout the country as a whole[1]. Barley acreage has shrunk most in Kent where it has been most affected by the depression in the Brewing industry and less in those counties where it is grown more generally for livestock. In general corn production has concentrated itself on areas of optimum soil and climatic conditions, E.Kent and S.W.Sussex showing the lowest percentage decrease in acreage.

The main corn exchanges of the region are shown on

(1) There has been a big increase in wheat acreage since 1932, after the introduction of the Wheat Quota system.

VARIATION IN CEREAL ACREAGE 1913-1930

Fig.90. Note: Widespread and comparatively uniform decrease.

Fig.87 and their relative importance may be judged from the following table.

TABLE XXVIII.

Amount of Corn Handled at Main Exchanges in S.E. England in 1927.

Exchange	Corn in cwts.
Chichester	192,000
Canterbury	134,000
Maidstone	97,000
Ashford	41,000
Guildford Redhill	34,000
Lewes	17,000

There are in addition other small markets where corn is sold, 5 in Kent, 12 in Sussex and 3 in Surrey.

Chichester serves the cornlands of Sussex and is the sixth provincial exchange in England and Wales for home-grown oats, while Canterbury lies in close proximity to the main corn lands of Kent.

Nowhere, however, are corn sales extensive[1]. The bulk of the barley crop, where it reaches the required standard, is taken by the brewers, but sales of other grain rarely assume more than local importance.

(1) Compare Norwich and Lincoln with a turnover in 1927 of 1,878,000 and 1,135,000 cwts respectively.

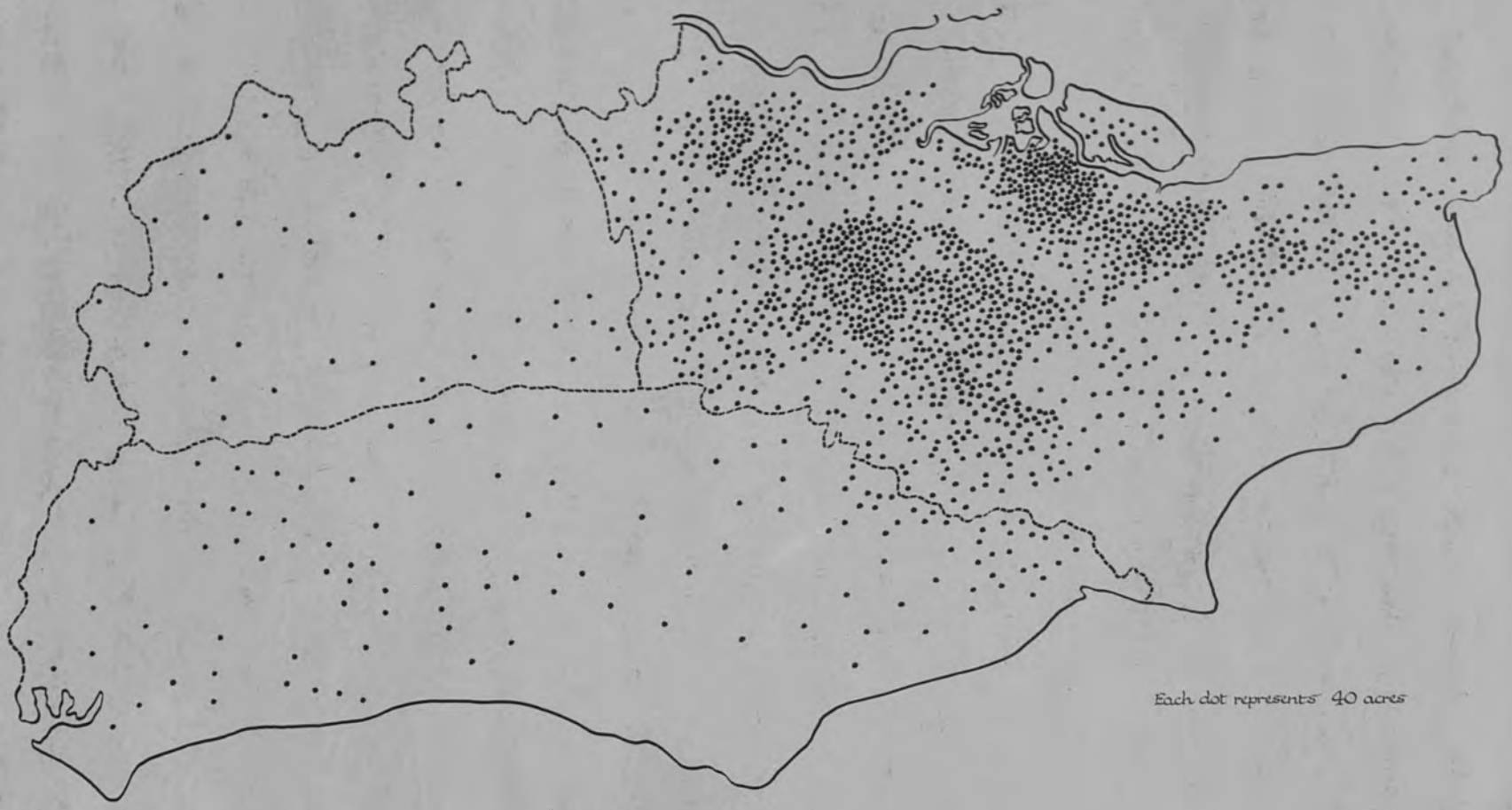


Fig.91. (a) Almost complete concentration of Fruit production into Kent.
(b) Concentration in Kent into three main areas: (1) Mid-Kent,
(2) Sittingbourne, Faversham area, (3) Swanley area.

Fruit and Hops.

Fruit and hop growing are ~~se~~ often linked in farming practice and have many features in common. Both require a high degree of specialisation and of capital expenditure, while the demands they make on soil and climate are somewhat similar. The widespread assumption however that land which has grown good hops will grow good fruit and vice versa is a fallacy and has given rise to much bad farming.

There are four main centres of fruit production, outside which fruit acreage is small and scattered (see Fig.91). They are the Swanley region, the Sittingbourne-Faversham region, the Ash-Wingham area and the Mid-Kent area. Each has certain characteristics of its own. The Mid-Kent area is the most extensive. It centres round the Medway valley from just N. of Maidstone southwards and stretches across the Weald Plain and up into the High Weald of Kent and E.Sussex. The most important fruit soils are the deep, well-drained loams of the Hythe Beds and their occurrence round Maidstone leads to the greatest intensification of fruit production in this area. On the Weald Plain and in the High Weald, where detailed investigation has been made it has usually shown that the fruit plantations lie on soils of alluvial origin.

The whole is primarily an apple-growing area. Neither soils nor climate are ideal for the highest quality fruit production. Soils tend to be too rich and rainfall too high for the production of the best colour in dessert fruit. The

DISTRIBUTION OF SMALL FRUIT AND CANNING CENTRES

Fig.92. Note: (1) Concentration of small fruit similar to that of orchard fruit.
(2) Great density of the Swanley area.
(3) Location of canning centres directly determined by growing centres.

tendency to over-richness in the Greensand soils is being overcome by the growing practice of grazing orchards - either completely, or allowing them to fall to grass about June. The grass takes up the surplus nitrogen supplies at the season when their superabundance is detrimental to fruit formation and colour. On the High Weald areas the high percentage of iron in the soil promotes good colour in the fruit and the growth of dessert apples is spreading in this area. On the whole, however, Kent has no great reputation for dessert fruit and the apple of the county is the Bramley Seedling. In the Maidstone district this variety accounts for about 70% of the total apple acreage[1].

These apples keep well in cold storage and most of the bigger growers have storage plant. It is a not unusual sight to find the old circular oast-houses disused for hops but fitted with cold storage plant and used as apple stores[2].

Besides apples, there is an enormous concentration of damsons in the Maidstone area and on the ridge tops, where

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(1) From a Paper on Fruit Production in Kent read to a meeting of Canners by N.Bagenal of the E.Malling Research Station.

(2) Apart from their suitability, the farmer finds it economic to store cooking apples because they do not have to meet foreign competition and he can get a good price for them in May or June. Apart from the highest grade dessert apples, for which demands always exceed supplies, and for which therefore, there is no incentive to storage, English dessert apples in general cannot face the competition of Colonial fruit, if they have to bear storage costs as well as costs of production. Several fruit growers stressed this point.

TABLE XXIX.

Fruit Production in Kent.

	Acres			
1930	Swanley	Sittingbourne	Maidstone	Canterbury
Strawberries	1,450	370	1,440	310
Raspberries	1,010	190	850	130
Currants & Gooseberries	1,490	2,120	3,640	1,790
Total Bottom Fruit	3,950	2,680	5,930	2,230
1925				
Plums	846	950	1,516	-
Cherries	225	2,362	1,684	-
Apples	3,182	3,317	8,042	-
Pears	857	1,043	1,121	-
Total Top Fruit	5,110	7,672	12,363	6,460
Grand Total	9,060	10,352		8,690

Table gives a rough indication of the distribution of fruit in the four areas. (Each area comprises land within a ten mile radius of each town.)

Figures arrived at as follows:

Those for bottom fruits represent the approximate acreages for the year 1930. Compiled from June 4th Returns of Min.of Agric.

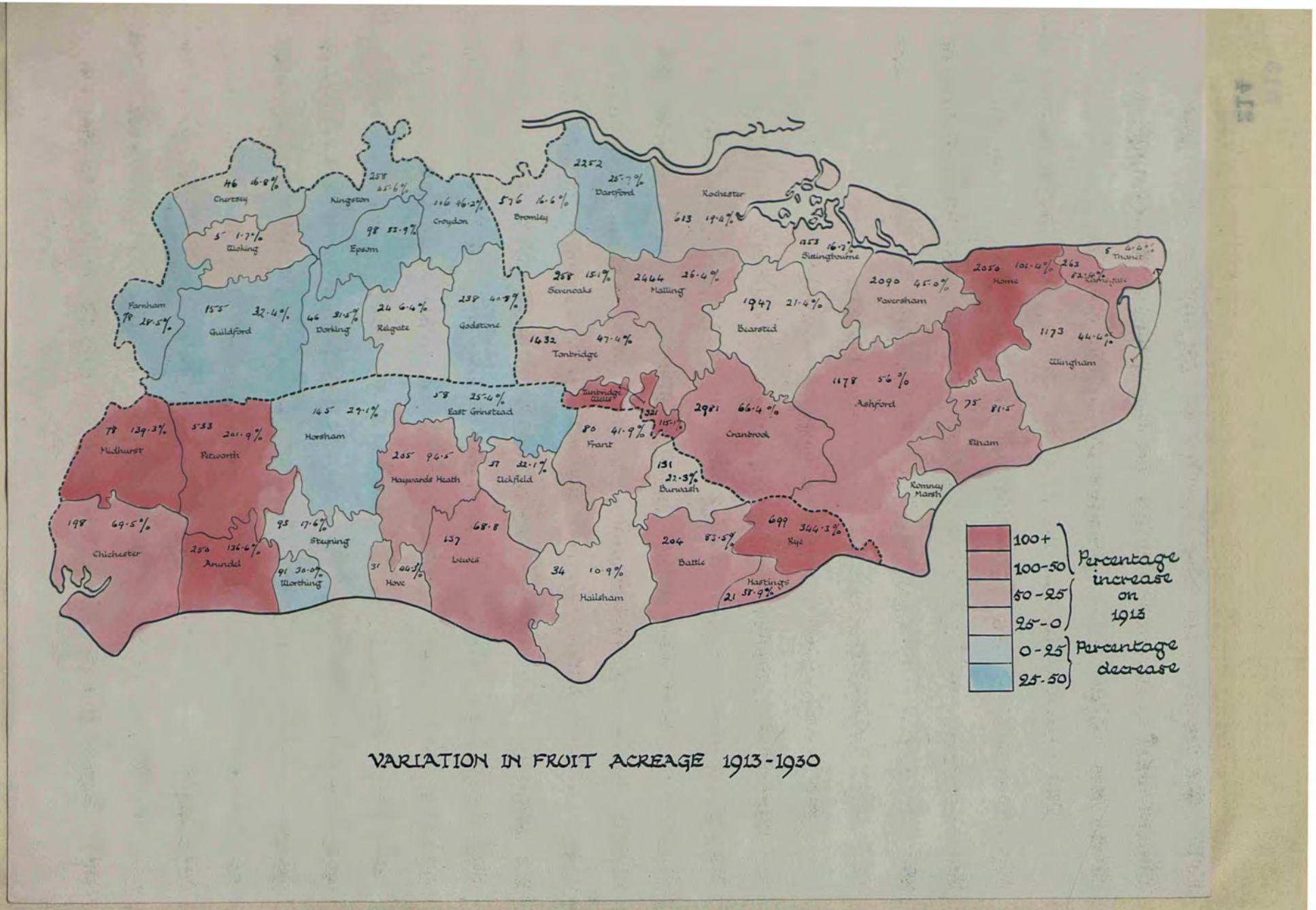
Ten fruit acreages have been calculated from a census of fruit trees taken by Min.of Agric. in 1925. By no means represent total acreage in the areas being taken only from parishes where concentration of fruit is heaviest.

(Table compiled at East Malling Research Station by the Technical Advisor).

soils are not very deep. Kentish cob-nuts are grown extensively. The most important bottom fruit are raspberries, currants and gooseberries (see Table XXIX), but, largely owing to canning developments, strawberries are rapidly assuming an importance they have not hitherto possessed and in 1930 the area within a ten mile radius of Maidstone carried almost as high a strawberry acreage as the Swanley area. This extension has been affected by improvement in marketing facilities offered by rapid road transport. Orchard fruit, however, remain of primary importance.

The best fruit soils of the Sittingbourne Faversham area are the Brick-Earths, though the orchards spread out on to neighbouring Thanet Sands and Chalk loams. This area is the main source of the country's cherry-supply. The Brick-Earths, high sunshine and low rainfall form the best possible environment for cherry growth. The orchards are predominantly grass, but for a different reason ~~than~~ from that leading to the grassing of Greensand orchards. A grass covering regulates the water supply and prevents a sudden supply of water from summer showers to the tree, which would result in sudden swelling and cracking of the fruit. The orchards need to be heavily stocked and carry large numbers of sheep, geese and poultry.

The East Kent area shows great variety of production. On small holdings in the Sandwich-Ash district, the lighter soils of the Upper Eocene beds are much used for small fruit, while



VARIATION IN FRUIT ACREAGE 1913-1930

Fig.93. Note: (a) Very widespread increase everywhere except in Surrey.
(b) Initiation of new fruit areas in W.Sussex.

round Canterbury, on the heavier Brick-Earths and lower Thanet Sands, orchard fruits assume greater importance and there are large farms growing plums and apples.

The Swanley region is most important for small fruit, and for strawberries and raspberries in particular. The light Eocene loams are here well suited to this type of production and the great incentive to its development has been the nearness and accessibility of the London market.

The very great growth in market demands is reflected in the enormous increase in fruit acreage everywhere but in Surrey, where the most suitable fruit lands lie in the area of maximum urbanisation. In Kent there has been a total increase of 15,178 acres and in Sussex of 2,258 acres since 1913. Fig.93 shows this variation in acreage by districts. The greatest increase in acreage has occurred in the Cranbrook district, i.e., in the High Weald area, and on the superficial deposits of the Low Weald, and it is largely concerned with soft fruit and with high-grade orchard fruit. Large areas have been planted to loganberries round Brenchley, Cranbrook, Horsmonden and Goudhurst and in the Weald Plain round Marden and Paddock Wood. With the exception of Dartford, the more important fruit areas all show considerable increase in acreage, while the E.Sussex area generally shows an increase. The small hop-gardens of this area have mostly been grubbed and

the land planted to fruit, not always successfully[1]. Though acreages are small, there has been a very marked development of the fruit industry in W.Sussex. Round Kirdford to the N. of Petworth, several large orchards of apples have been planted in the last six or seven years. These are producing dessert apples for the London market and this move to scientific production of high-grade fruit is extending throughout the area. (There is an old-established and very specialised dessert-gooseberry production in the Chailey area).

The general extension of acreage everywhere is due to increased home demands, both for fresh fruit and for canning and to the failure in recent years of hop prices.

Whether destined for the London market or for the Midland or Northern markets most fruit is sold through Covent Garden. The bigger growers often do not concern themselves with local markets, either retail or canning but send all their fruit to Covent Garden where not infrequently they have their own selling organisation. There are no centres for the wholesale marketing of fruit and where the grower does not pick and sell his own produce, it is the custom to sell to "hagglers" who come and collect fruit and sell at a commission in the seaside towns or other local markets. Much fruit is sold on the trees and the farmer is not concerned with its picking and marketing. This practice is especially prevalent in the cherry

(1) Hop soils are frequently too heavy and not sufficiently well drained for good fruit growth.

area and is largely due to the combination of fruit and hop farming. The sale of the fruit on the trees leaves the farmer free to devote his energies and labour supply to his hop-gardens. A further instance of the influence of hops is to be found in the practice of stripping the early variety apple trees before hop-picking whether the crop is in best condition for marketing or not. The farmer is in danger of having his trees stripped for him should he wait till hop-picking starts and this accounts largely for the often unripe condition of apples offered early in the season.

The nearness and size of its markets has affected Kentish fruit growing in various ways. The farmer has a market for his entire crop, good, bad or indifferent. The price he makes on low grade fruit often gives him as good a margin over production costs as that on high grade and this, as already observed, has tended to retard the movement towards scientific specialisation and concentration on quality production. It has also meant that various efforts at cooperative grading and marketing have failed since this only pays with high grade fruit and the farmer who sent his fruit to the packing station found he had no outlet for his low grade stuff and the price he realised on the graded fruit did not equal the price he could realise on the entire ungraded crop. The larger growers all practice grading to a varying extent and the modern non-returnable deal case is steadily replacing the old bushel

basket but there is no organisation of marketing in Kent comparable to that of, for instance, the Evesham area.

Similarly the canning industry which started to expand in the Eastern and Midland counties in 1924, is a development of only the last two or three years in Kent. Its effects, however, are likely to be far-reaching. The canner demands a standard product at a stable price over a period of years. He must be sure in advance of the quality and quantity of his season's supply, i.e., his demands can only be met by the most scientific type of fruit farming.

The price he offers is only likely to attract large scale producers, who cut down production costs by the use of machinery, and therefore the tendency is to bigger scale, more scientific farms. In return the farmer is assured of a stable income from his orchards and is freed from the risk of low prices attendant on glut years.

Existing canning factories are shown on Fig. 92 . They vary in size and importance, the largest being those at Paddock Wood and Barming near Maidstone. The factory is erected usually on a site adjoining the railway and draws its seasonal supplies of mainly female labour from surrounding villages. It draws on fruit supplies usually within a radius of 10-15 miles and contracts with growers within that area, specifying certain varieties and grades of fruit. Growing for canning is, of necessity, a specialised industry, since the

best canning varieties are rarely the best varieties for the retail market. Strawberries, raspberries, plums and currants are the fruits most commonly canned, together with a large quantity of second grade Bramley Seedling apples. Cherries are not extensively canned, as the supply never exceeds the demand of the fresh fruit market[1].

Road transport is now almost universally used by growers within a thirty-mile radius of London and is becoming increasingly common even from fruit districts as far distant as East Kent. Apart from its usual advantages of flexibility and directness, road transport offers certain other advantages especially applicable to the fruit industry. Owing to weather conditions, it is not always possible for a fruit grower to have his crop ready by the time the fruit train is due to start, or the train may start so early from its initial point that fruit must be picked the previous afternoon. In either case there is considerable delay between the time of picking and marketing, very detrimental to soft fruit. Lorries can be loaded at convenience and often in the orchard (which saves further handling) and immediately despatched.

The important hop areas coincide closely with the fruit districts (see Fig.94). This crop makes major demands on

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(1) There has, however, been little extension in the cherry acreage, chiefly owing to the fact that cherry trees take eight or nine years before they come into bearing.

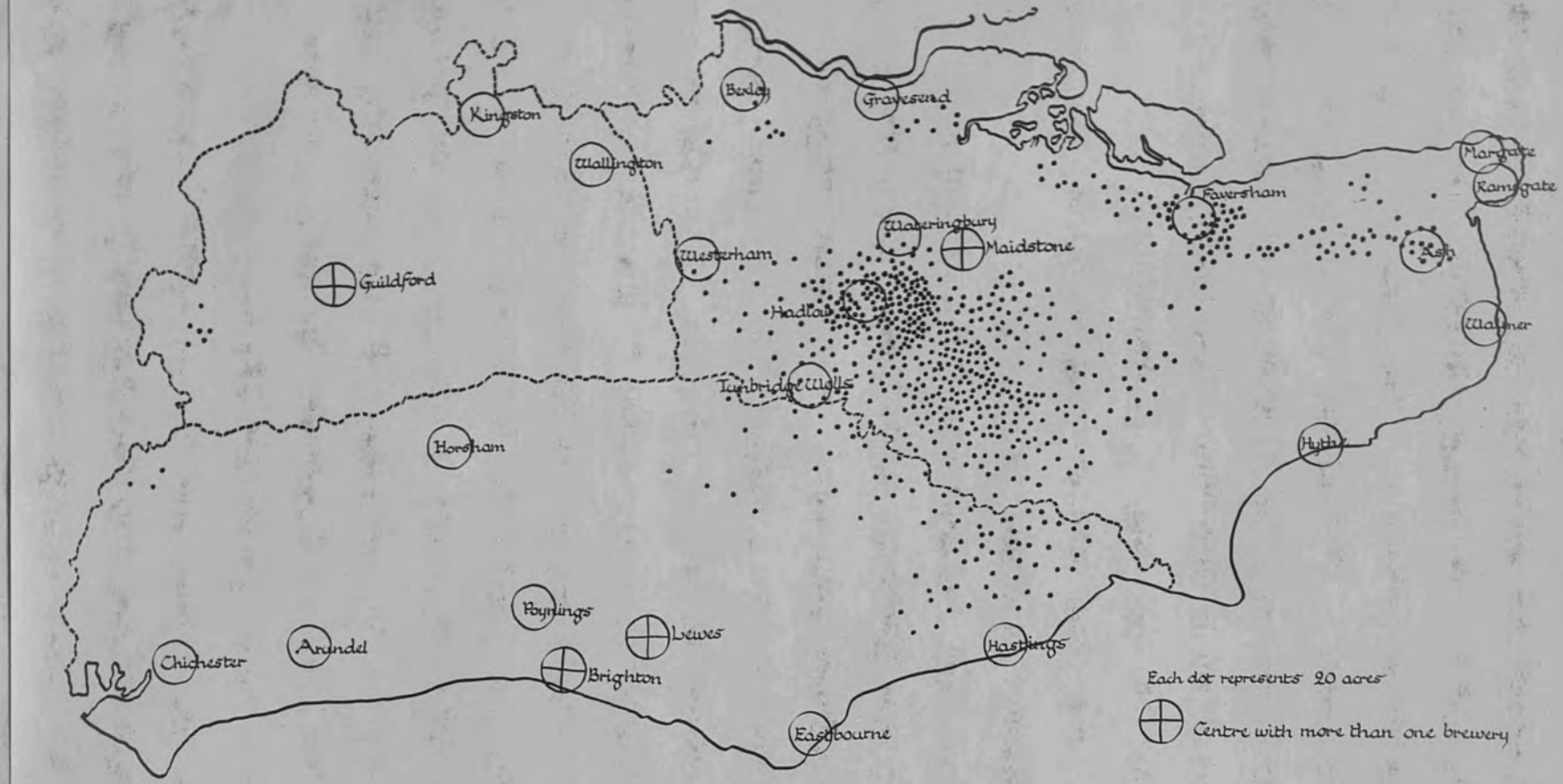


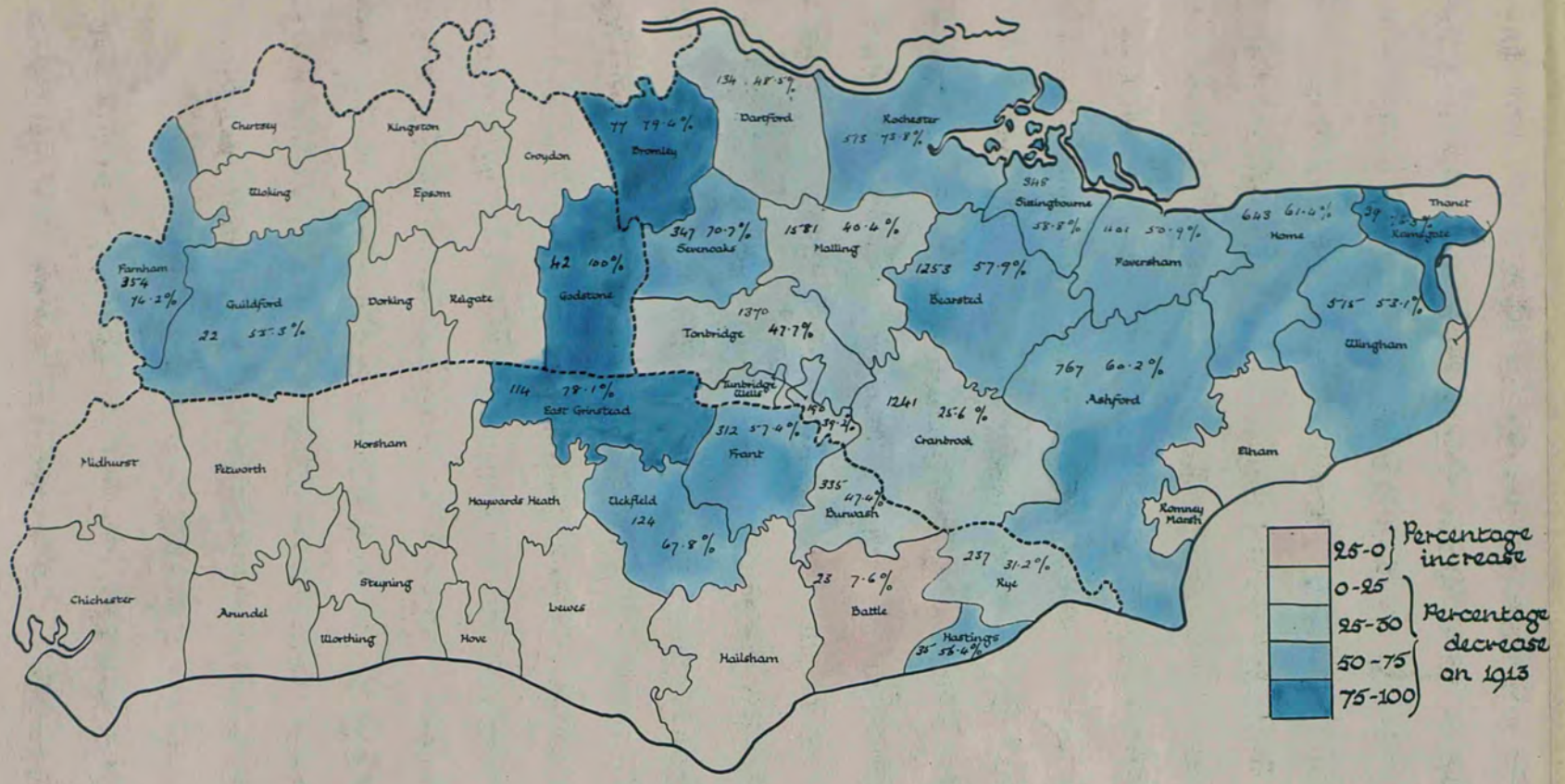
Fig.94. Note: (a) Completely local nature of hop production.
(b) General widespread of brewing centres. Market control of greater importance than presence of hops and barley.

soil conditions, on capital expenditure and on labour supply. The two most important areas are the Medway valley centring round Yalding and the Faversham district, and the important soils are the Brick Earths of each district. Hop cultivation spreads on to neighbouring soils, though in general the Thanet Sands are too light to make it successful. There are small scattered hop gardens throughout the Weald, though their present extent is much less than formerly.

The highest grade crops are grown in the Faversham district. These "Goldings" will only grow on the best soils and in Mid-Kent and the Weald tend to be replaced by coarser, stronger and more prolific varieties. Where fruit and hops are grown together, hops occupy the lower-lying heavier lands.

The history of hop growing is one of increasing specialisation and concentration on to areas of superior natural conditions. Originally widely grown in scattered gardens throughout England, production is now limited to Worcester and Hereford, Kent and Sussex and of a total acreage in England and Wales in 1930 of 20,000 acres, Kent and Sussex accounted for 13,500 acres. This shrinkage in acreage (see Fig.95) has been accompanied by big increases in yields per acre, most marked in Kent where yields are highest.

The falling prices, due to decreasing home demands and increasing competition from foreign hops, causes the greatest emphasis to be placed on high quality production, and has



VARIATION IN HOP ACREAGE 1913-1930

Fig.95. Note: (a) Widespread Decrease.
(b) Relative Decrease greater in the hop areas of N. and E. Kent (where the finest hops are grown) than in the Mid-Kent area, but absolute decrease highest in Mid Kent.

intensified this process of specialisation. It was the practice throughout the Weald for a farmer to have a small hop garden, growing poor grade hops to which he devoted but little attention, but from which he got a money crop. To-day there is no market for these hops, this type of garden is disappearing and the industry is in the hands of the specialist grower who produces large quantities of high grade hops. He has his yearly labour supply well organised and offers proper accommodation to the yearly influx of pickers from S.E.London.

As there is great specialisation in hop growing, so there is great organisation in hop marketing. It is the only branch of agriculture to which the Agricultural Marketing Act of 1931 has as yet been applied. The Hops Marketing Board, set up under the provisions of the Act, is the successor of a voluntary cooperative organisation which was not entirely successful mainly owing to the incompleteness of its reach. Hops have only one market and no by-products, therefore any decline in the beer industry or over production in hops reacts immediately on prices. Complete organisation of the marketing, by which prices can be controlled, and supplies held back till favourable moments for disposal, has therefore proved beneficial during the short period it has been at work.

It is convenient here to deal with the brewing industry in the S.E., although it absorbs but a small proportion of the total hop production.

In the past the brewing industry was largely located by close proximity to raw materials in the form of malting barley, hops, or both and to a plentiful and suitable water supply. The importance of Maidstone illustrates these points. To-day the presence of a big consuming market may be of as much or even more importance and has caused the development of brewing at places like Brighton and Eastbourne. In certain areas, notably in Thanet, there is a combination of raw materials at hand and of a big consuming population.

The distribution of breweries is shown on Fig.94. Many of these are small and supply only a very restricted local market. Others, as at Hythe, Faversham, Kingston and Guildford supply a very considerable and widespread local demand.

Maidstone is the biggest centre of brewing and it is only here that supplies are produced for external markets, for the London area. The growing importance of markets in locating industry is illustrated by the transference of the London trade of one of the larger Maidstone breweries to an allied London brewery. Brewing, like hop-production is becoming concentrated at certain points within the area, and is characterised by many amalgamations of recent years.

At Maidstone the main breweries lie either alongside the river or have easy access to it. It has been, and still is to a lesser degree, an important transport medium, and supplies a cheap and plentiful water supply suitable for certain process

requirements. Coal comes up by barge and a considerable amount of beer is sent down to Rochester and London, though this traffic is diminishing and as in every other industry in Kent, road transport is becoming increasingly important. Maidstone, as the centre of the road and rail net enjoys every facility for easy distribution. Local barley is mixed with Californian barley (which has certain characteristics rendering it peculiarly useful in brewing); the majority of the hops used are naturally of Kentish origin. Some breweries have hop-gardens of their own, but this is not the general practice as it is felt it might lead to a reduction in quality of output attendant on the use of brewery-grown hops, whatever their quality[1].

The by-products of brewing, (i.e., grain and hops after the beer is drawn off) are either sold wet to neighbouring farms for cattle food, or are dried and sent to a firm of cattle food manufacturers in Battersea. The second method has the advantage that the product can be kept for a certain period and therefore the supply and prices controlled.

The breweries have their own malting kilns, but usually have to supplement their own supply from outside areas, largely from East Anglia and the Midlands. Malting was once an important industry in Thanet and the Isle of Grain but disappeared with the growing practice of malting at breweries. Brewing is still an important absorber of labour. The Maidstone

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(1) Much of the material of this section was supplied by various Maidstone Brewers.

breweries with their maltings, cooperages etc., employ upwards of 500 persons, but their trade and consequently the numbers they employ is considerably less than formerly. This is partly due to the general decline of the industry throughout the area and partly to the transference to London already remarked.

Market Gardening.

The presence of a large urban market naturally makes market gardening an important industry to-day throughout the South East.

The whole area is characterised by small scattered nurseries which grow a variety of produce for purely local markets and the South coast towns are fringed by market gardening areas where a ready market encourages the industry to develop almost irrespective of soil conditions. Large scale production is, however, developed in certain well-defined areas, which are distinguished by different crops and types of production.

In Kent there are three main areas, the Dartford-Swanley region, the Faversham region and the Ash region. In Sussex, market gardening is concentrated particularly in the district round Southbourne and extending from Bosham to Emsworth, and in the area round Sompting, Lancing and Worthing. In Surrey market gardening was formerly much developed in the Northern part of the county where the fertility of the soils was based on a cheap supply of stable manure from London and the camps at Aldershot. Much of this area has gone in building development, large supplies of cheap manure are no longer available and the low prices of produce of late years have given little incentive to the building up of the necessary fertility on

DISTRIBUTION OF POTATOES

Fig.96. Note: Big concentration in market gardening area of N.E.Kent.

new lands. Market gardening as a large-scale, specialised industry has largely disappeared and has been replaced by scattered market gardening on small farms and holdings where some stock is kept.

In Kent the soils most utilised are the light warm Thanet Sands but from these market gardening spreads on to the heavier lower Eocene formations and on the chalk loams, which, where they are free from superficial deposits are often light, warm and free-working. Brick Earths and alluviums are also utilised.

The character of the gardening changes,with distance from the Metropolis, from the most diversified type to large-scale one-crop production forming part of farm routine rather than market gardening proper.

The Dartford-Swanley area produces a great variety of vegetables and salads and in this district is the only gardening under glass in the county. Flowers are chiefly grown and ~~with~~ some tomatoes, but the latter are usually grown only as a catch crop. It is the practice for gardeners in this area to grow potatoes as a rotation crop to clear the ground and this accounts for the very large concentration of potato acreage here (see Fig.96). There is, however, no specialisation in potato growing: they are main-crop potatoes and the grower is concerned with them only as a by-product to his main activities[1].

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(1) N.B. Potato growing is also encouraged because many growers sell their own produce at Covent Garden and like to be able to sell potatoes as well as their other vegetables.

In the Faversham district broccoli and cabbages are the most important crop. This type of gardening extends into Thanet, which is one of the biggest broccoli-producing regions in the country. The crops are grown on large holdings; 500 acre farms are not uncommon and large areas are commonly under one crop. This type of gardening is mainly a result of the changes in general farming practice from cereal production. The farmer has turned from corn to cabbage, and then by a slightly higher degree of specialisation to broccoli and brussels sprouts etc. Kent is the biggest producer of cauliflowers and broccoli in England. In 1931 the acreage in the six leading counties for this crop was as follows.

Kent	3,228
Cornwall	2,599
Yorkshire	1,300
Worcester	564
Staffordshire	501
Essex	460

The Ash-Wingham-Sandwich area, the original home of market gardening in England, is again characterised by a more diverse type of farming, due to the variety and suitability of soil, but more especially to the age and long tradition of gardening here. Mixed vegetables are characteristic of this area and of late years, asparagus growing has been developed. The asparagus is grown in plantations between fruit trees, without any special treatment, and good yields of very fine produce show that the natural conditions here favour the crop.

The industry is very small as yet.

In Sussex, in the extreme S.W. market gardening area the Brick-Earth soils are worked and in the Worthing district, both Brick-Earths and Coombe-deposit soils. The high Spring temperatures and freedom from cold drying winds makes this area important for the production of early vegetables and the most important crops in each area are early potatoes, peas, beans and other vegetables, while salads are less important. There is a high degree of specialisation in glasshouse culture round Worthing. The industry here is very similar in type to that of the Lea Valley: tomatoes, cucumbers and grapes are the main crops, while in the Autumn the houses are used for chrysanthemums which have been grown in the open during the Summer.

Figures relating to the acreage under market gardening are difficult to obtain since so often vegetable growing forms part of general farming and no separate returns are made for market gardening as such. Therefore the growth in the industry cannot be demonstrated in the same way as the growth in other branches of agriculture.

Table XXX shows that variation in the acreage under the main vegetable crops during the last decade has only been marked in the case of green vegetables. The increase in the area under brussels sprouts and broccoli in Kent has been enormous.

TABLE XXX.

Total acreage under Main Vegetable Crops in Kent, Surrey and Sussex 1921 and 1931.

	Carrots		Onions		Brussel Sprouts		Cauliflower or Broccoli	
	1921	1930	1921	1930	1921	1930	1921	1930
Kent	179	243	183	192	734	1322	1660	3071
Surrey	159	109	96	47	220	241	185	180
E.Sussex	31	37	27	13	78	151	57	107
W.Sussex	47	44	33	28	166	300	117	183

The degree to which vegetable growing forms a specialised industry is shown in the following table.

TABLE XXXI.

Total acreage under vegetables and comparison with acreage under vegetables on specialised farms in Kent, Surrey and Sussex.1924.

	Total Veg.Acreage.	Total Veg.Acreage on special farms*	% of Total Veg. acreage grown on special farms.
Kent	28,125	14,387	51
Surrey	7,244	2,278	31
E.Sussex	3,173	639	20
W.Sussex	3,077	1,472	48

In common with fruit production, vegetable production is frequently combined with other farming practice, but the large vegetable acreage in Kent, and the greater degree of specialisation in that county and in W.Sussex reflects the superiority of the Tertiary soils and Brick-Earths for this type of agriculture.

For all the Kent areas of specialised production and for Worthing the main market is London, whereas from the Southbourne district produce is drawn into Portsmouth. Practically all

*i.e., Those on which vegetables occupy more than half the total area.

produce is road-borne, even from the E. Kent area[1]. Most of the big Kent growers have their own stands in Covent Garden and large quantities of cheaper grade vegetables are handled at the Borough Market in S.E. London which is well-placed for the receipt of N.Kent produce. Produce also goes to Smithfield and Spitelfields and the proximity of markets together with the fact that many growers are their own salesmen, either wholesale or, more rarely, retail has not encouraged any development of cooperative marketing. Increasing attention is, however, paid to grading and packing. In spite of the big development and proximity of local markets, especially in Surrey, there is little selling direct from grower to consumer such as was remarked in the dairying industry, because the greengrocer is expected to offer a great variety of produce both English and foreign. The marketing of his crops offers considerable difficulty to the smaller grower who does not produce in sufficient bulk for wholesale marketing in London to be profitable and who would need to supplement a satisfactory retail industry with a large amount of produce beyond his own production.

The extension of market gardening seems assured in this region where soil and climate offer suitable conditions for a big range of development (from the early vegetables of Worthing to the big-scale broccoli production of Thanet); where transport

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(1) Cf. Transport of fruit.

facilities are excellent and markets near. It has been found difficult, however, to get a sufficient supply of cheap rough labour, preferably female, required for weeding, picking and the various other processes where hand labour is indispensable. The industry suffers greatly from Continental competition, mainly from Holland and Belgium where tradition has made supplies of this type of labour more plentiful and where production costs are lower.

Vegetable-growing for the canning industry is, as yet, little developed. In the Maidstone district a certain amount of peas are grown from seed provided by the canning firms who thus insure the right varieties, while at Deal, an old-established bottling and canning factory, producing a restricted output of very high grade quality draws on the peas of the Sandwich-Ash area. It is probable that the canning industry will prove an expanding market and as in the case of fruit, it will demand close cooperation between producer and consumer.

Poultry farming.

Poultry farming, which has assumed importance since the War in most agricultural districts has been an important branch of agriculture in S.E. England for a very long period. It has formed, and still does form, part of general farm management and there is no great development of specialised poultry farming as such. The exception to this rule is the fattening industry of the Heathfield district.

Chicken-breeding and egg production are important throughout the area and especially in the High Weald, where agriculture generally is diverse and small-scaled. The farmer does not generally fatten his birds but sells them to the "crammers" of the Heathfield neighbourhood where the highly specialised art of cramming has long been practised. The fattened birds are sent by lorry to the London market where they are sold as "Surrey capons" and command the highest prices in the poultry market. There is in addition a ready market for hens no longer used for egg production in the poorer districts of S. and S.E. London.

The following table shows the number of fowls in the three counties.

TABLE XXXII.

No. of Fowls in S.E. England in 1913 and 1930 and Percentage Variation.

	1913	1930	Increase %
Kent	1,034,373	1,474,371	42·6
Surrey	330,436	471,327	42·3
Sussex	896,237	1,385,234	54·5

While the total number of fowls is greatest in Kent, the increase since 1913 is most marked in Sussex. Egg production is important, and has passed very little into the hands of the specialist poultry farmer. The estimated production of eggs on agricultural holdings of over one acre in a recent year is as follows[1].

Kent	65·3 millions
Surrey	20·5 "
Sussex	56·8 "

To these figures about one-third should be added to cover production from holdings of under one acre.

The usual form of marketing is by auction. There are 24 markets in the region where eggs are auctioned and the most important of these is Ashford, one of the largest auctions in

(1) Ministry of Agriculture.

the country. Maidstone, Guildford, Chichester, Heathfield are large markets and at each, packing stations under the National Mark Scheme are operating. Other markets are small.

Cooperative methods of marketing have rapidly developed in the industry. There are three cooperative organisations, one in Surrey and two in Sussex. The larger of the Sussex organisations extends its operations far into Kent and partly into Surrey and has recently (1933) opened a subsidiary packing station at Wye in Kent. The eggs are collected, tested and graded at the central packing station at Stonegate, near Heathfield or at Wye and then delivered by road straight to retailers in London or the South Coast towns.

The rapid and recent progress in cooperation is illustrated by the increase in the number of members and the number of eggs handled by this society during 1926-1931.

	Number of Members	Number of Eggs.
1926-1927	14	671,538
1927-1928	60	1,075,560
1928-1929	117	1,636,488
1929-1930	235	4,216,140
1930-1931	365	6,340,176

The success of the egg industry here as elsewhere in England depends on the maintenance of quality. Organised

collecting, grading and marketing tends to regularise supplies, to keep up quality and maintain the confidence of the retailer in the product of any given region. Cooperation thus gives advantages to the producer which mere proximity to markets does not outweigh.

It has been the aim throughout this section on agriculture, to describe the main types of agricultural practice and to show the way in which the agricultural life of the region is changing, seeking the underlying environmental causes for the change.

The broad development from general farming with emphasis in certain areas on fruit and hops, to specialised production of milk, of fruit and hops, and of market garden crops has been indicated, together with changing methods of marketing and transporting produce. In this general survey, much detail has necessarily been omitted.

Chapter V.

GENERAL TRANSPORT CONSIDERATIONS.

Transport conditions and methods in individual industries have already been considered. It is proposed here to make a short survey of the general transport system of the region.

Water Transport.

There is little development of inland water transport in the counties under consideration. The importance of the Thames frontage to the cement and paper industries has already been shown. There is no point of special shipping concentration and the usefulness of the whole North Kent Thameside is limited to the stretch where these industries are located and is thus purely local. To the W. of Greenhithe and to the E. of Gravesend wide mud flats border the river.

The region is drained by a multiplicity of small streams, none of which offers much opportunity even for barge traffic except the Medway, and this is navigable for barges from Rochester to Tonbridge, but the volume of traffic above Maidstone is very small indeed and amounted to no more than 5,000 tons of cargo in 1930. The Darent and Cray are

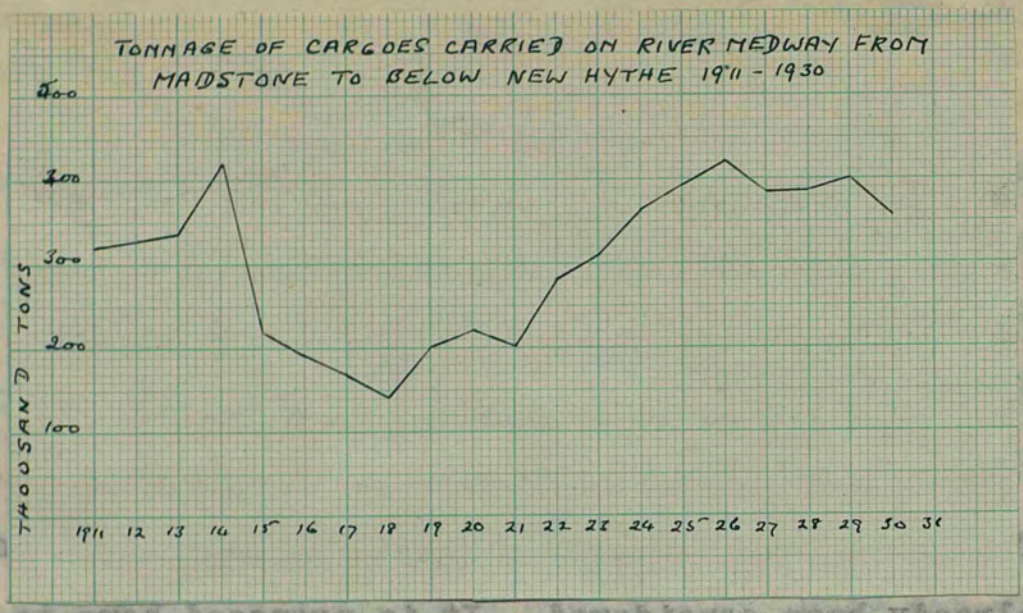

Fig.97.

Note: The steady increase, with a slight later decrease in volume of traffic since the War period.

Prepared from statistics obtained from the records at Allington Lock.

navigable for barges as far as Crayford and Dartford and are used to a limited extent by the industries at Dartford. From Maidstone to Rochester the Medway has a fall of only about two feet in a mile and is subject to serious floods. It swings across its floor in broad meanders until the steeply rising chalk hills confine it to a straighter course above Snodland. Apart from its meanders, (and it has been straightened at certain points), it offers as direct a route between Maidstone and Rochester as the rail which follows it closely and a more direct route than the road which serves the industrial part of the valley. The industrial region stretches from a little above Maidstone to the Medway mouth and traffic above New Hythe[1], i.e., from that part of the valley unaffected by the closing down of cement works, shows a general increase since 1911. Fig.97 shows the tonnage of cargo on which tolls were charged at Allington lock during the period 1911-1931, and this represents the total traffic for five miles above Maidstone.

Traffic carried up is chiefly coal and timber, pulp for the paper mills and corn for the flour mills at Maidstone. The downstream traffic, much less in quantity, is mainly paper and beer, roadstone and Hassock from rag-stone quarries adjoining the river at Allington and Tovil and sand and gravel from sandpits at Aylesford. Paper traffic has increased since the

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(1) The site of the new Aylesford Paper Mill.

opening of Aylesford Mills and the beer traffic has very considerably decreased. Petrol tanks line the river, but to-day petrol transport is mostly by road.

Although the total Medway traffic has increased, this increase is not commensurate with the growth of the middle Medway valley as a manufacturing region. The relative importance of the river as a transport medium has declined. The traffic of the lower reaches must be considered in connection with Rochester.

Kent and Sussex have long sea-boards and are characterised by a number of small ports of varying importance, which, though often having a small foreign trade, are mainly concerned in the coasting trade and in some instances in fishing. Dover, Folkestone and Newhaven are the only ports where foreign trade assumes any considerable size and the foreign trade of these ports is not concerned with the requirements of their hinterland, nor does it reflect the nature of that hinterland. The trade of the smaller ports, by contrast, and the coastwise trade of the larger ports is closely connected with both these factors.

The most important of this group of small ports is Rochester, the natural outlet by water for the industrial Medway valley. The whole of the river from Sheerness to Burham (6 miles above Rochester) constitutes the port, but

Fig.98.

Note: (a) The greater relative importance and yearly fluctuations in imports, primarily due to their greater variety of type.
(b) The smallness but steadiness of the export trade.

(Prepared from "Annual Statement of Navigation of U.K.")

steamer traffic is stopped at Rochester Bridge and the major proportion of the trade is concentrated on Rochester itself. The port is located at the first point up the Medway where the wide saltings bordering the river give place to solid chalk banks, allowing for easy construction of wharves and store-houses near the deep water channel, and for a small dock at Strood. The dock can only accommodate vessels of 400 to 500 tons, but has good shore conditions, ample room for sidings and easy connection with the main rail line at Strood. The shallowness of the river makes Rochester essentially a lighter and barge port. At one coal wharf[1] on the S. bank vessels of up to 2,500 tons can discharge by crane, but in general vessels lay afloat and discharge into lighters and barges. The berths afloat can take steamers of 8,000 tons. The main imports are coal (which forms 80% of the total coastwise imports), stone for road-making, china clay and pulp for the paper industry. Flour and corn for the millers of Chatham and Maidstone and pil for the growing petrol refining industry of the port itself. Exports are stone from the ragstone quarries bordering the Medway, paper and petrol, oilcake and seed (from Maidstone), scrap iron and a greatly diminished amount of cement.

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(1) This wharf has large areas of storage sheds and accommodation and of railway sidings with direct connection with London and the coast and the large coal trade of Rochester is mainly due to the facilities it offers.

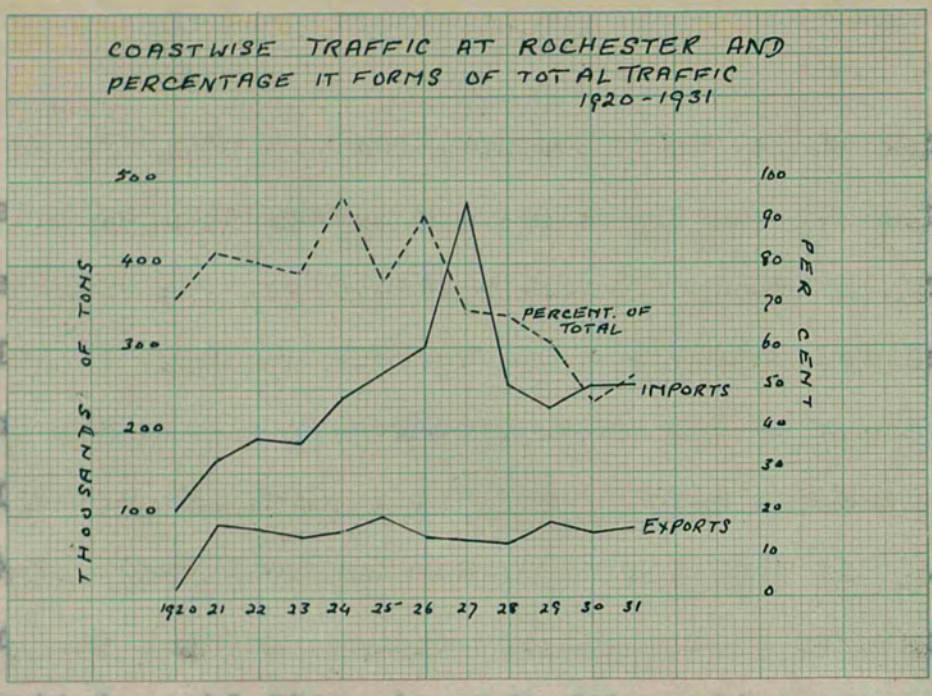

Fig.99.

Note: (a) The gradual increase of coastwise traffic.
(b) The decreasing relative importance of coastwise traffic as a result of increasing petrol and paper trade.

(Prepared from statistics furnished by the Harbour authorities of Rochester.)

Figs 98 and 99 illustrate the relative importance of coastwise and foreign trade and of the imports and exports in each class. Imports greatly exceed exports (the tendency for manufactured goods is to go by rail and road), but the most marked trend of the trade of recent years is the growing importance of foreign trade. This is associated with the rapid development of the paper industry and of petrol refining. The port has always been closely associated with transport industries. The manufacture of steam wagons is long established, while the opportunities offered by the smooth wide expanse of the Medway just above Rochester bridge have fostered the growth of seaplane manufacture on the S. bank. The growth of petrol refining reflects a further phase in this development, a response to the rapid development of road transport[1].

The outports of Rochester are Sheerness and Port Victoria on either side of the Medway mouth. Sheerness is concerned almost wholly with naval shipping and the line of dockyards continues along the S. bank at Chatham, but at Port Victoria, on the Isle of Grain, there is wharfage accommodation at low tide for vessels up to 20,000 tons capacity, and direct rail connection from the pier head to London via Gravesend. At this point considerable quantities of oil are imported and stored.

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(1) For the concentration of road traffic on Rochester, see Fig. 105

Queenborough[1] is concerned with Swale shipping. Geographical conditions here have already been discussed in connection with the Kent coal traffic of the port (see Chap.II). The poorness of port facilities and the restricted nature of its hinterland makes the total trade of the port very small. Coal is the most important commodity. East Coast coal is imported and supplied to Kent coastal towns and Kent coal is shipped in steamers to France and Channel ports and by barge to London. Other traffic is concerned with the small chemical and glass making industry at the port itself. With the development of coal exporting facilities at Dover emphasis on Queenborough as an outlet for Kent coal will diminish and there is no indicated development of its hinterland which seems likely to develop its trade.

The port of Faversham extends from King's Ferry on the Swale (the E. limit of Queenborough) down to Reculver and includes the tidal creeks of Faversham, Milton, Conyer and Oare and the harbour of Whitstable. For many years Whitstable and Milton creek have been of more importance than Faversham creek. Milton, because of the Sittingbourne brick industry and the growing importance of the paper industry, and Whitstable because of the development of the harbour after the building of the Canterbury-Whitstable railway and the concentration of fishing, especially oyster fishery, at this point.

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(1) There are no records of tonnage in and out of this port which forms one of the London group.

The whole of this coast is bordered by wide sandy flats and marshes; channels are narrow and tortuous. To meet the requirements of its hinterland, conditions, in the Milton area, have been improved and Ridham Dock constructed (see Chap.III), but at Faversham and Whitstable external stimuli to development has decreased with the decreasing brick trade at the one and the decreasing fishing industry at the other. Faversham creek is only navigable for vessels of less than 250 tons and trade is restricted to the import of coal and timber, fertilisers, petrol and oil and brick-making materials. The only export is of bricks (rapidly diminishing) and of craft from the shipyard where steel lighters, tugs and small steel craft generally, are constructed. Apart from the ship-building at the naval dockyards, Faversham is the only remaining centre of ship-building round the Kent and Sussex coast. Yachts are built at Littlehampton and Shoreham, but of the former extensively developed ship-building industry, connected with the near supplies of good timber and iron from the Weald, the small yard at Faversham alone remains. The ships constructed here are mostly for use in the Thames, but a certain number go abroad[1].

Some indication of the small size and the type of Faversham's trade is shown in the following table.

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(1) Some of the African Lakes steamers are from this yard.

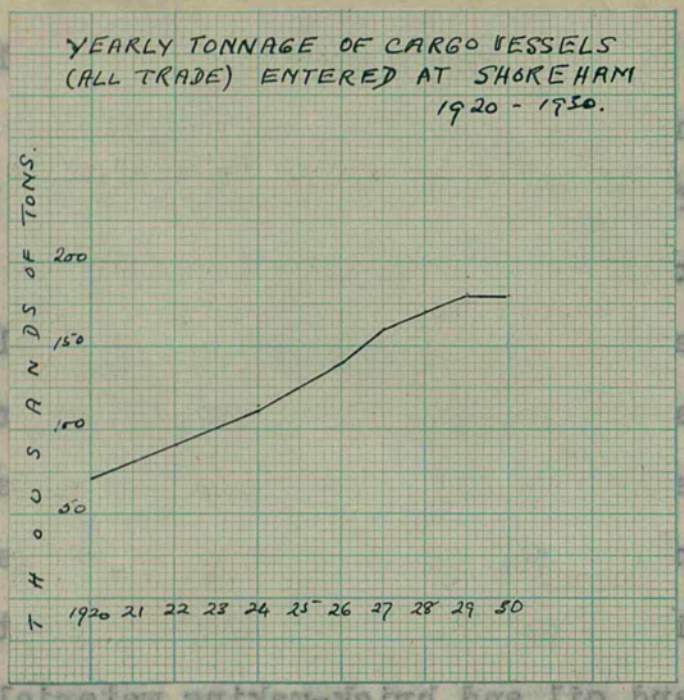

Fig.100.

Note: The steady growth of traffic since 1920.

(Prepared from the records of Shoreham Harbour.)

TABLE XXXIII.

Tonnage of shipping entering Faversham 1928-1931[1].

	Coastwise	Foreign	Total
1928	31,041	183	31,224
1929	32,172	606	32,778
1930	27,872	173	28,045
1931	34,305	495	34,800

Trade at the old ports of Sandwich and Rye is now negligible. The silting up of their harbours and the absence of any stimulus to development in their hinterland has rendered them both little used and now almost useless.

Shoreham and Littlehampton offer a complete contrast, and show a considerable growth in trade due to the stimulus of a rapidly expanding residential hinterland.

The growth of the traffic at Shoreham is shown in Fig.100. Exports are negligible and the imports are mainly coal, oil, and building materials (i.e., timber, bricks and tiles, granite, etc.). Formerly the port was concerned with the industrial development of its hinterland and bricks and cement were exported. To-day, the enormous housing developments along this stretch of the S. coast necessitate the import through Shoreham

(1) From information supplied by the Port of Faversham authorities.

of both these commodities. The trade of the port is greatly restricted by physiographic disadvantages. High water at neap tides gives only 13 ft. of water at the harbour entrance. On entering there is a difficult right-angled turn and vessels proceed westwards into the River Adur where neap tides give only 11-20 ft. of water or eastwards into the locked canal which follows the coast and is separated from the sea by a long narrow shingle bar. The Depth at H.W.O.N.T. in this canal is only 13 ft. but recently (1933) a new lock has been opened which will maintain water in the canal at a level all the year round approximating to that of H.W.O.S.T. The old lock has been turned into a dry dock. Shore conditions are good. The long level water front on either side of both river and canal gives ample opportunity for wharfage, storage and transport facilities. The main coastal road and railway follow the water-front and connect the port directly with the densely populated strip of hinterland which it serves. The facilities the port offers for coastwise traffic and the availability of suitable sites adjoining the water-front has caused a development of the small scale diverse industry typical of the Brighton district to group itself in this area. Gas and electrical undertakings, brewing, food and drink preparations, soapworks, all industries connected with the demands of a residential population. An important aspect of the harbour is the facility it offers in its long shallow stretches of water for the

mooring of yachts and other pleasure craft, and yacht-building is a further reflection of its close connection with its hinterland. The market for its industries lies at hand, and though their growth may stimulate the import trade of Shoreham, the export is not likely to be augmented. The development of trade is thus restricted in volume by the physiography of the harbour and in diversity by the nature of the hinterland.

The relative importance of the main commodities which enter into it are shown in the following table.

TABLE XXXIV.

Trade at Shoreham 1930-1931.

Imports.

Coastwise		Foreign	
Coal	180,842 tons	Timber	26,340 loads
Oil	38,057 "	Building Materials (other than timber)	87,207 tons
Granite	34,693 "		
Wheat	4,145 "	Vegetables	1,031 "
Soap	1,901 "		
Manures	4,220		

Exports.

Scrapiron	1,118 tons.
Pitch	2,216 "
Wood	639½ loads.

Fig.101.

Note: (a) The very great importance of the Foreign trade of Dover, Folkestone and Newhaven compared with that of Rochester.

(b) The decrease in the trade of Newhaven and Folkestone since pre-War years and the increase in that of Dover, due mainly to the increasing facilities offered at Dover.

At Littlehampton, there is far less trade than at Shoreham, both owing to the less developed nature of the hinterland and to poorer harbourage. The channel of the Arun is shallow and narrow and the port is only able to accommodate vessels up to 200 ft. in length and of about 14 ft. draught. Shore conditions are good. At the point where the port is located, the Arun swings into the chalk and overlying Brick-Earth and there is little spread of river alluvium. This, in conjunction with the level topography, gives opportunity for good wharfage and storage development and direct connection with main rail and road transport lines. The trade is similar in type to that of Shoreham. Coal, road-making materials, timber and other building materials, artificial fertilisers (in connection with the arable farming area behind it) constitute the bulk of imports, while exports are negligible. The tonnage cargo handled in 1930 was 69,000, only about 18% of that of Shoreham, and about equal to that of Faversham. The trade of the port is, however, increasing with the growth of its hinterland. Figures of cargo tonnage over the last decade are not available, but the revenue from harbour dues has increased from £200 in 1920 to about £2,000 in 1932.

The major ports of Dover, Folkestone and Newhaven are concerned mainly in transit trade. Newhaven is concerned to some extent with the demands of Brighton and Folkestone and

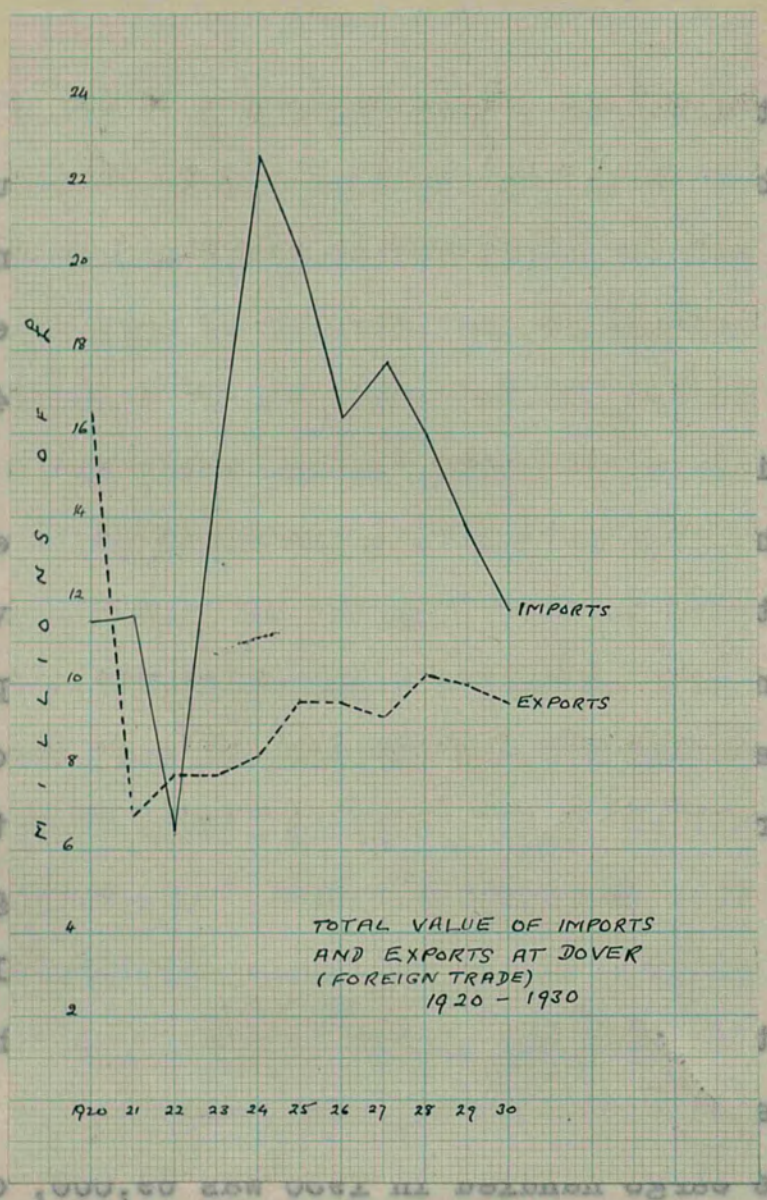

Fig.102.

Note: (a) Relative importance of imports.
(b) The gradual increase of exports since 1921 (an increase greater than is shown here because of the fall in commodity prices since 1921).
(c) Big fluctuations in the import trade reflecting its luxury type.

Dover are themselves considerable population centres, but the bulk of the trade at all these ports is through traffic between London and the Continent and is attendant on the Cross-Channel services operating at each port.

The character of the trade of Dover is being modified by the industrial development of its hinterland and its position in this connection has already been described in Chapter II. Apart from this special coal trade at Dover, the coastwise shipping at Dover and Folkestone resembles that of Shoreham. There are no separate figures available to show its size, but it is concerned with the immediate needs of a residential hinterland and coal, building materials, wheat, etc., are the main commodities. The industrialisation of the hinterland of Dover is shown only in the export of coal and the import of pit-props. At Newhaven where the pull of an immediate population demand is very small, coastwise traffic is correspondingly small.

Newhaven, an estuarine port, has the advantages of most ports of this class: a long water front, good opportunity for wharfage and storage development and ease of connection with land routes. The absence of coastal plain at Newhaven and the steep rise of the Downs on either side of the flat Ouse valley causes routes to concentrate on the Ouse valley and restricts their E - W development. Rail traffic for Brighton or Eastbourne (the major population concentrations near the

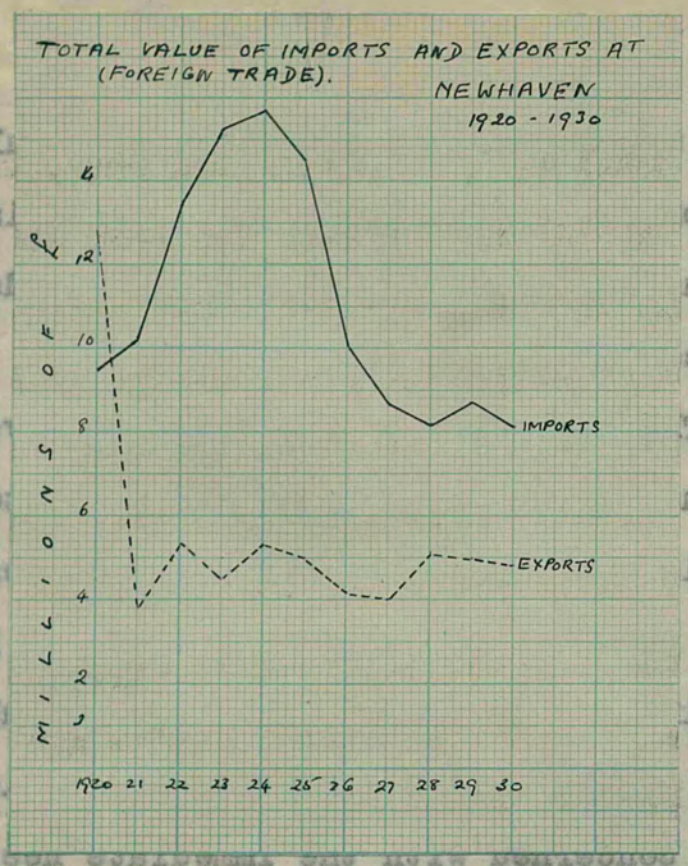

Fig.103.

Note: (a) The steadiness of exports compared with imports.
(b) General decrease of both. (N.B. The fall in commodity prices partly accounts for this.)

port) must go by a circuitous route through Lewes and any close connection between the port and its immediate hinterland is thus discouraged. The advantage it possesses over the other estuarine ports of the region is that of deep water and with this it combines the shortest land route from a South Coast port to London and the shortest sea route to Dieppe and the mouth of the Seine, i.e., to the Paris Basin. The big transit trade resulting from these circumstances, shows the bigger pull of the larger London market in the excess of imports over exports.

Folkestone and Dover have natural harbours at breaks in the chalk cliffs where valleys run inland from the coast. At Folkestone the gap is formed by the seaward end of the narrow Gault valley and the harbour is enclosed by the chalk scarp to the N.E. and the Greensand hills to the S.W. The physiography of Dover has already been described. Both, by reason of their closely encircling hills experience similar difficulties of landward approach and shore development. Difficulty of landward approach is less acute at Folkestone where the Gault valley offers an easy route westwards. Superior harbour conditions, the existence of docks, the construction of the Admiralty harbour (now available for commercial trade) and the short sea connection with the Continent, make Dover the main focus of the Continental trade, despite difficult shore conditions.

Fig.104.

Note (a) Relative importance of imports (cf. Newhaven and Dover) and their fluctuating nature.

(b) The comparative steadiness of the export trade.

(c) The general decline in both imports and exports. (N.B. This is partly to be accounted for by a decline in commodity prices, and is not wholly indicative of a decrease in trade.)

Table XXXV The Main Commodities entering the Foreign Trade of Dover, Folkestone and Newhaven. 1930 Value in £.

	Dover	Folkestone	Newhaven
IMPORTS			
Foodstuffs	633,000	2,377,000	679,000
Raw Materials	-	4,200	-
Manufactured Arts	69,418,000	1,962,000	6,969,000
Miscellaneous Arts	1,650,000	80,000	550,000
EXPORTS (a) of British Goods			
Foodstuffs	-	312,000	166,000
Raw Materials	58,000	-	33,000
Manufactured Arts	2,427,000	626,000	2,688,000
Miscellaneous Arts	613,000	142,000	643,000
Parcel Post	2,706,303	-	-
(b) of Foreign and Colonial			
Foodstuffs	32,741	61,000	14,000
Raw Materials	3,263,817	26,000	52,000
Manufactureds Arts	367,000	870,000	1,080,000
Miscellaneous Arts	148,000	194,000	184,000

(Compiled from Annual Statement of Trade of U.K. issued by Board of Trade).

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The trade of all three ports, though differing somewhat in detail, is of the same type, transit trade in high-priced goods of small bulk, i.e. it is trade which makes the least demands on storage and handling facilities at the ports and is peculiarly suited to fit in with harbour conditions at Folkestone and Dover. The disadvantages of Dover became acutely apparent when the port was called on to deal with a bulky, cheap grade commodity.

At Dover and Newhaven the main imports are textile goods. At Dover, in 1930, the value of the total import of manufactured goods was £9,000,000 and of this, £7,000,000's worth were silk and wool goods and apparel. At Newhaven the proportion was nearly as great. Folkestone is largely concerned with the import of foodstuffs from France. Raw fruit, cheese, vegetables, and wine are the most important.

The exports from all three ports are varied. Cotton goods are important and from Dover there is a big export of raw wool to the manufacturing regions of N.France.

The volume of trade at these ports is dependent on market conditions exterior to the area and also on physical conditions at the ports which control the size of ships and cargo-handling facilities. Their greatest asset is their nearness to the Continent and in an endeavour to increase facilities for quick transport a dock and quay is in process of construction at Dover for a cross-Channel train-ferry to Calais. There are also

proposals for improving shore conditions by connecting the Eastern Arm of the harbour to the main railway by a tunnel[1].

It is becoming increasingly common for liners from the North Sea ports to make Dover their port of call going down Channel, but communication must be by tender and this is a development concerned only with passenger and mail traffic.

Land Routes.

Land routes are controlled by the alignment of the Downs and the position of the gaps through them. Main traffic lines all run from the coast to London, and with the exception of Watling Street (which nevertheless concentrates on the chalk gap in order to cross the Medway), must all cross the chalk at least once and often twice. The topographical control results in an entirely satisfactory net of links with London, but the complete concentration of the routes on London leads to a certain isolation of the region from the rest of England. This is especially true of Kent where the barrier offered by the Thames estuary to the N. makes the London route control complete. More direct and easier connection with the growing industrial areas of Essex and with the Midlands and N. of England will be obtained by the construction of a tunnel under the Thames from Purfleet to Dartford (this is now under

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(1) See Chap.II.

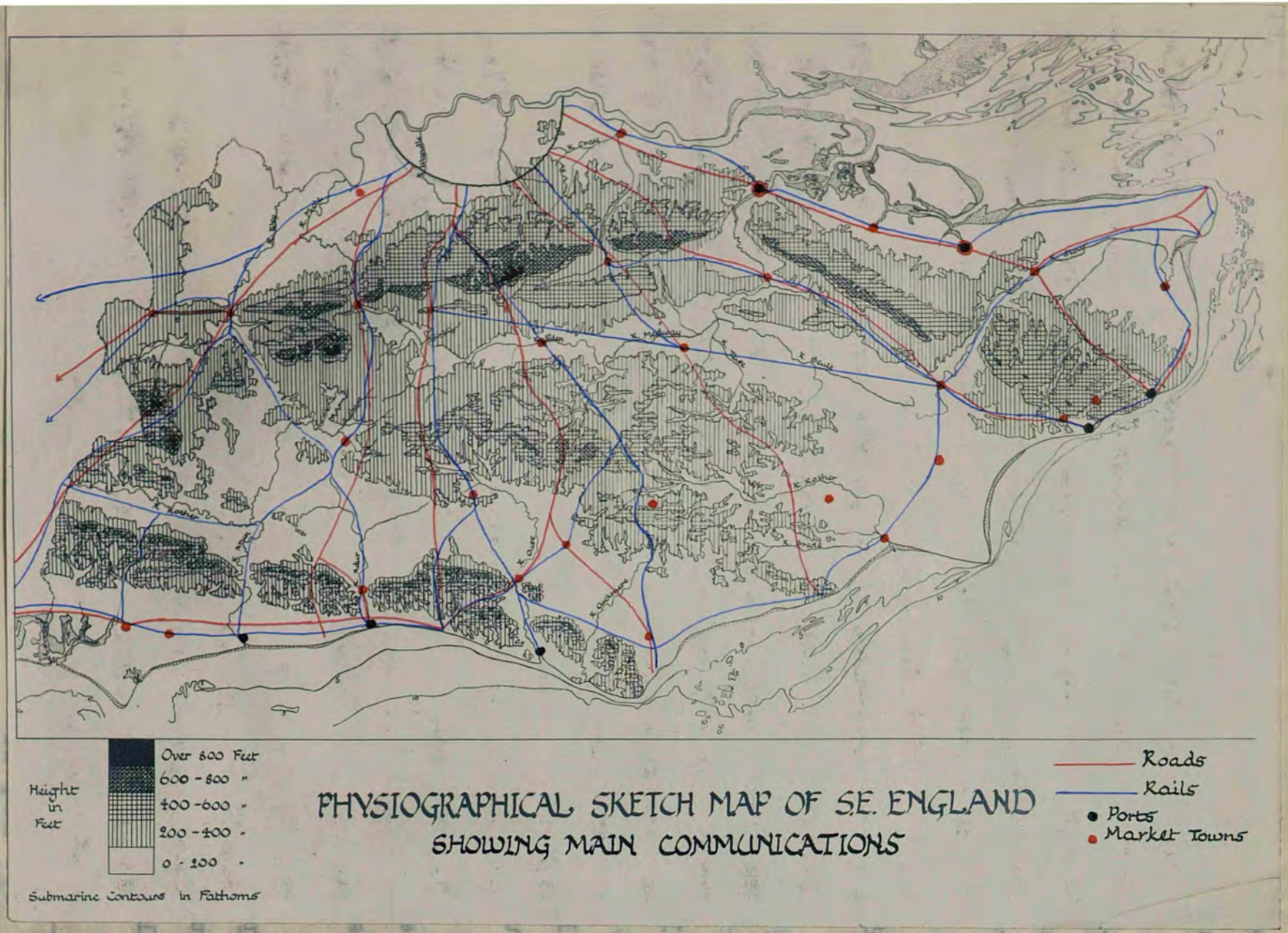

Fig.105. Note: (a) The topographical control which concentrates routes (1) on Gap Towns, (2) on London.
(b) The importance of routes in the location of market towns generally.

consideration) but only a road connection will be obtained this way.

Inside the chalk rim rail routes follow the river valleys in the High Weald and Lower Greensand areas, and the clay vales of the Gault and Weald Clay, whereas the roads follow the ancient trackways, which, for drainage reasons, follow the ridge-tops of the High Weald, avoid as much as possible the Weald Plain and Gault Valley, seeking rather the lower dip slope of the Greensand Ridge and the scarp face of the Chalk.

To cross the Downs both roads and rails concentrate on the gap towns. Railways either follow the river gaps, or where the route thus offered would considerably deflect them, they turned through a shoulder of the chalk in close proximity to the valley route (e.g. the main S.E. line between Orpington and Sevenoaks).

At certain points, where a valley route is unavailable, the rail pierces the Chalk by a short tunnel at a point where a coombe running far up the dip slope offers an easy route e.g. at Caterham and Chaldon on the N. Downs, carrying the main London-Brighton line and at Cocking on the South Downs carrying the main Chichester line.

Road routes, less controlled by gradient than rail, nevertheless focus on the gap towns, whether they subsequently follow the valley or not. (see Fig.105).

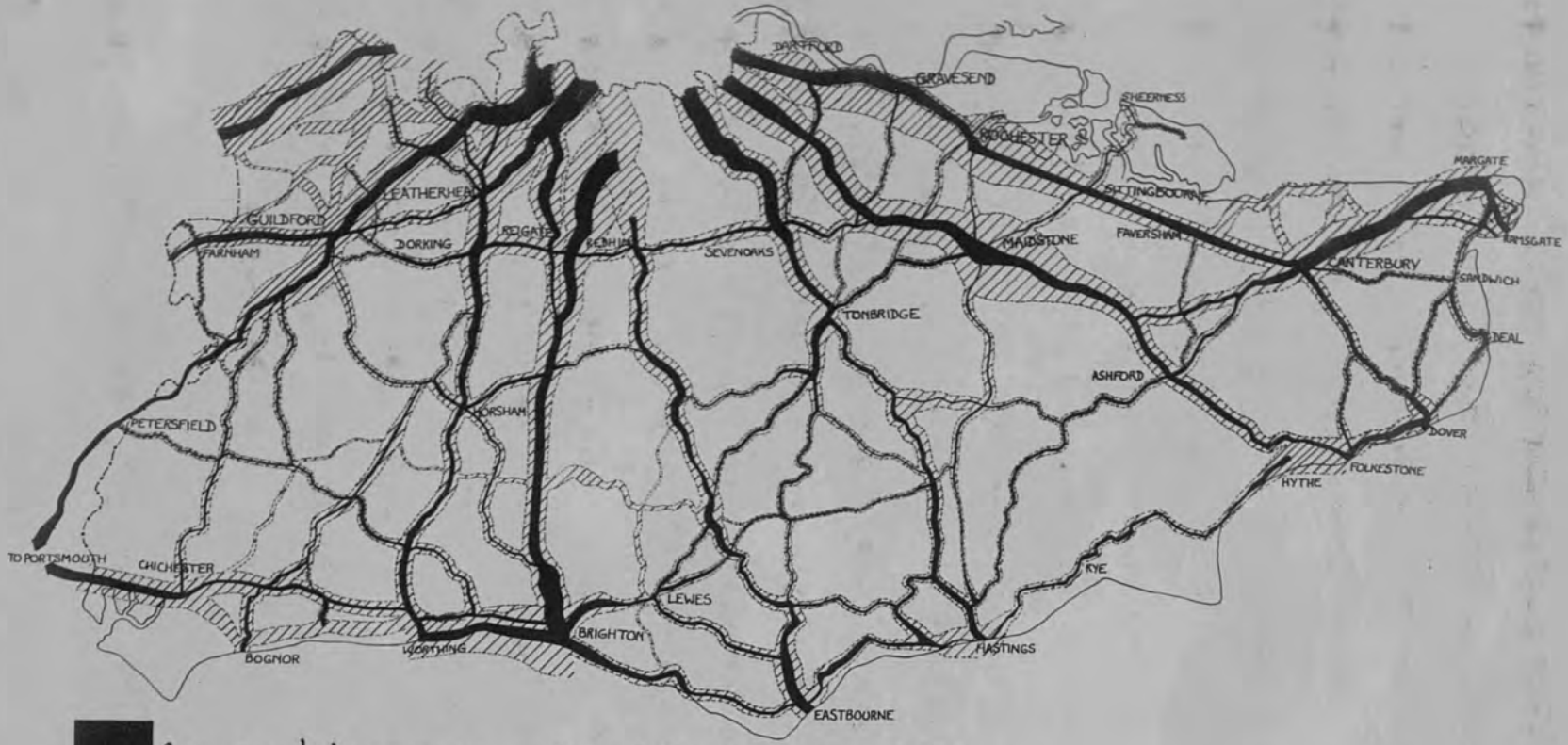

Fig.106. Note: (a) Great volume carried on main routes to the coast.
(b) Comparatively small transverse traffic.
(c) Great concentration on Rochester and Maidstone.
(Prepared from statistics extracted from the Traffic Census of the Ministry of Transport.)

The main roads between London and the Coast concentrate on Rochester-Chatham (Watling Street), Maidstone (London-Folkestone Road), Sevenoaks (London-Hastings Road), Redhill (London-Brighton Road) and Guildford (London-Portsmouth Road). Two of these routes, the London-Folkestone and the London-Hastings Roads no longer follow the gap lines which would deflect them to the N.E. but cut across the Downs by steep gradients. In the W. part of the area, the valley lines in general offer the most direct routes and are still followed. Thus everywhere concentration on the gap towns has grown steadily with the increase of road transport. Fig.106 illustrates this point. The enormous volume of traffic carried on the London-Brighton road shows the steadily growing suburban character of this area, and the concentration of traffic on Rochester and Maidstone bridges and at Guildford, emphasises the nodality of these points. Always associated to a certain extent with transport industries, this increasing traffic concentration serves to foster their development. Those at Rochester have already been noticed, and there are motor lorry manufactures and petrol refining both at Maidstone and at Guildford.

Traffic across the area is negligible except in certain of the coastal areas.

The development of rail transport of recent years has been closely concerned with the gradual outward spread of

suburban lines and electrified train services. It emphasises the growing suburban nature of the whole area which has been already illustrated in every phase except the industrial development of the Thames-Medway area and the new coalfield.

Chapter VI.

REGIONAL PLANNING.

The central theme of this thesis has been an analysis of the changing values in the economy of the S.E. counties. Under the authority of local government bodies, regional and town-planning schemes have been prepared for a large part of the area. They represent a recognition of existing facts and an attempt to control future development and as such, a brief study of them summarises present conditions and the probable future development of the area.

The object of the preparation of regional planning schemes is to facilitate the economic development of the region; to preserve its existing beauty as far as possible; and to safeguard the health of the future community.

The degree of detail with which the areas have been planned varies greatly and for certain parts there is, as yet, no scheme propounded. Where they exist, they in general delimit the following types of area:- Zones considered suitable and likely to be needed for urban and industrial development; rural areas; areas which it is desirable to preserve for open spaces. In addition the road and rail net considered necessary to a

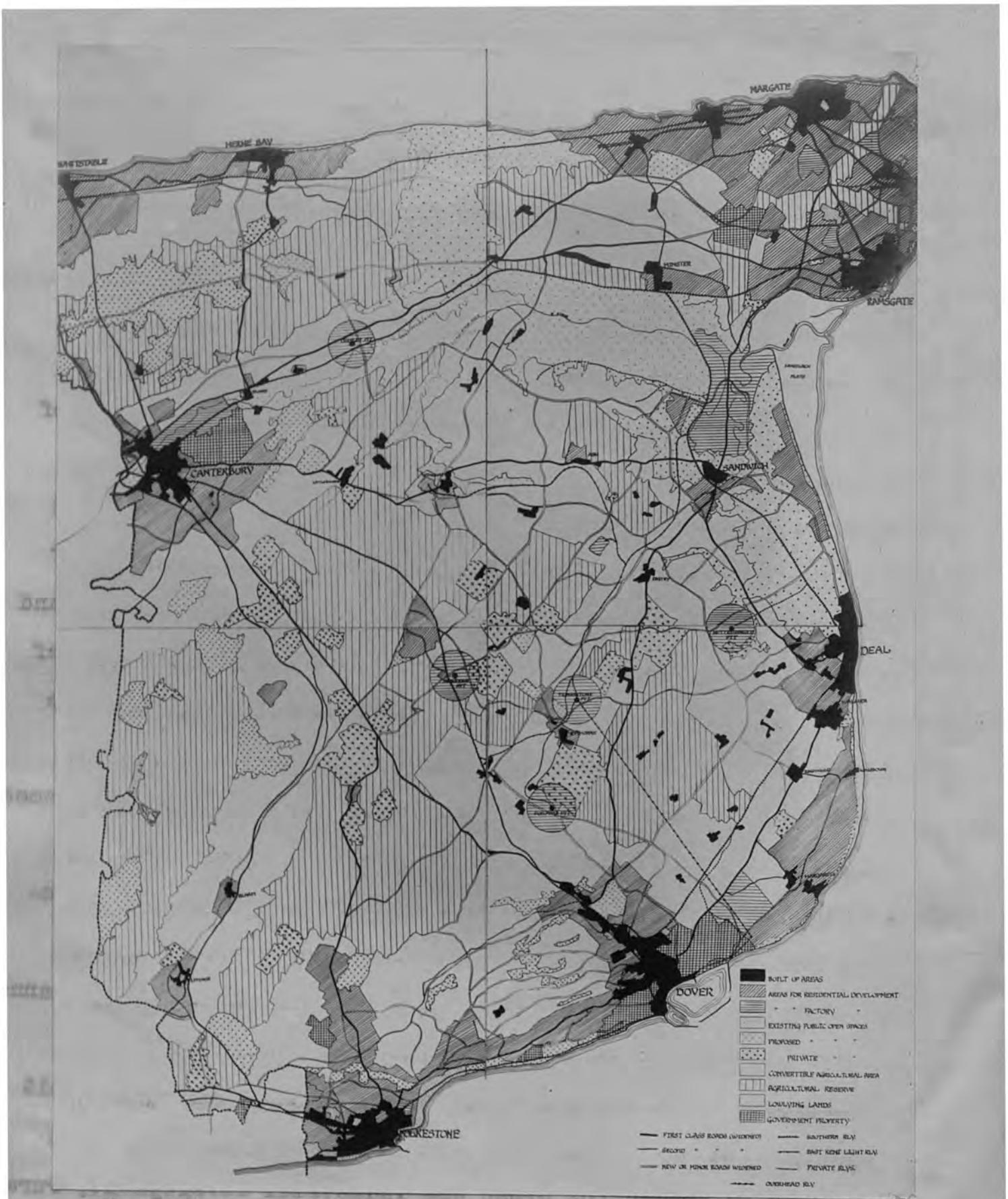

Fig.107.

Regional Planning Scheme for E.Kent.

Note: (a) Immense amount of colliery and industrial development expected.

(b) Settlement of future population mainly round existing centres.

Prepared from maps in "East Kent Regional Report" 1928.

proper development of the area is indicated. It is unlikely that future development will follow in detail the plans prepared, but they serve as a broad guidance for municipal authority and as an indication of future trends.

The earliest prepared scheme was that for East Kent, the region which by nature of the sudden industrial development, was considered likely to show sudden and rapid changes in population densities, distributions and occupations, which would need careful control.

Fig.107 shows the main features of the scheme finally prepared in 1928 to cover this area. It was drawn up with elaborate care and great detail and, as already observed, the changes and industrial growth it anticipated, have been but very partially realised. The zoning plan of the region was based upon two elements, the topography, and the probable position of the coal mines and of the coal ports. The area was divided topographically into three zones. The Low-lying Zone, that subject to "scott" for drainage purposes and mostly under the 12' 6" contour; this land was considered quite unsuited for housing purposes and generally unsuited to factory development. The Neutral Zone, lying between the "scotted" lands and the 50 ft. contour. It was considered this land should be avoided for housing wherever higher land is available[1], but could be utilised for industrial development. The

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(1) N.B. Sandwich, Deal, and many villages are situated on this zone despite its lowness.

Agricultural Zone above the 50 ft. contour, parts of which could be transferred to residential and limited industrial use; this area divides itself into three parts, Blean, Thanet and the land S. of the Stour valley. In general the aim of the plan is to concentrate residential development into a few cheaply and easily drained sites and to keep the land best suited to industrial development free from encroaching houses. The advantages of residential concentration are particularly marked in a chalk region where the water supply is deep-seated and expensive to obtain and where main sewerage drainage is particularly desirable in view of possible pollution of that water supply.

The areas for residential development are grouped mainly round the existing centres of population, i.e., round the coast and adjoining Canterbury. There are only two areas which have not as their nuclei an existing village or town. One is the site of Aylesham designed to house the population working the Snowdown and the proposed Adisham pit, and already partially built, and the other is the Sandwich Bay area, designed for high class residential development where for many years there have been a few large houses. There is thus a very limited amount of entirely new settlement planned. Big areas for residential use are reserved round the coastal towns and along the cliffs between Walmer and Dover and Dover and Folkestone. By this method it is hoped to prevent "ribbon" and other

haphazard and uneconomic development. Industrial reserves are of three types. Small areas in or near population centres as in Folkestone, Thanet and Canterbury. An existing industrial area (e.g. a brickyard or generating station) often forms the nucleus of these and they are to be regarded more for local than general industrial use. Within a half-mile radius of each pit-head zones for industrial use have been reserved. As yet there has been no development within these zones except the manufacture of coal bricks at Tolmanstone. Lastly, independent factory areas, the site of which, it is anticipated, will be controlled by the selection of the port for coal export. Areas have been tentatively selected on the cliffs above the Eastern Arm of Dover harbour and in the Stour estuary. At these points, convenient for the import of foreign ores, any development of heavy industry in connection with the utilisation of local ores should be placed.

Recent development at Dover make it probable that this will be the main point of exit for the existing collieries, but the future, though necessarily limited[1], use of Richborough may accompany further exploitation of the N. part of the field. The possible sites of future pits is indicated on the map. It is extremely unlikely that the coalfield will ever be worked by as many. In March of 1933, Sir Richard Redmayne, formerly Chief Inspector of Mines, stated that the coalfield

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(1) See Chap.II.

offered space for eight collieries each with a potential production of a million tons a year[1].

The agricultural land has been divided into two classes. That adjoining main routes, or areas of probable residential development which may be required for residential or industrial development and which is therefore zoned as convertible agricultural land, and that which should be reserved wholly for agricultural use. This land avoids those areas where development is likely or would be economic and includes much of the more fertile land of the region. Areas which should be reserved as open spaces have been selected along the edge of the cliffs between Walmer and Folkestone; on the open downland which follows the high ridges of the chalk hills to the W. of Dover; on the scarp crest of the Downs behind Folkestone; and among scattered areas of wood and parkland, notably in the Forest of Blean and on the hill slopes to the W. of the Celham valley. It is also assumed that many of the existing private parks will eventually become available for public acquisition. Should the region attain the maximum amount of economic development optimistically expected of it, it will not lack for "lungs".

The existing system of communication is on the whole adequate to existing needs. A coastal route is necessary to link Watling Street near Faversham with Whitstable and the

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(1) In evidence before a Select Committee of the House of Lords on the Dover Harbour Bill.

Thanet towns and thus relieve the enormous present traffic concentration on Canterbury. This route is already under construction. The road net proposed to meet future needs aims at providing a system of main roads, composed of existing Class I and Class II and new roads linking up industrial areas, along which heavy and through traffic will be canalised, together with the existing local roads which will continue to serve the original agricultural needs of the district.

The only rail developments considered necessary are local improvements to the Southern Railway at Dover and Canterbury and an expansion of the East Kent Light Railway or private mineral lines to meet the needs of future collieries.

Planning has been more difficult here than elsewhere in the S.E., where development may be expected to follow along existing lines. Here it must of necessity be tentative, since the extent to which industrialisation will proceed is problematic and largely dependent on exterior economic forces. That detailed planning to meet big future development has been undertaken, is, however, a hopeful sign that this region will not be a victim to the unsightly and often uneconomic utilisation which has so seriously spoiled many of the older coalfields.

The planning of N.E. Kent has been based on the following considerations:- That urban development within the region is likely to take the form of the expansion of existing towns

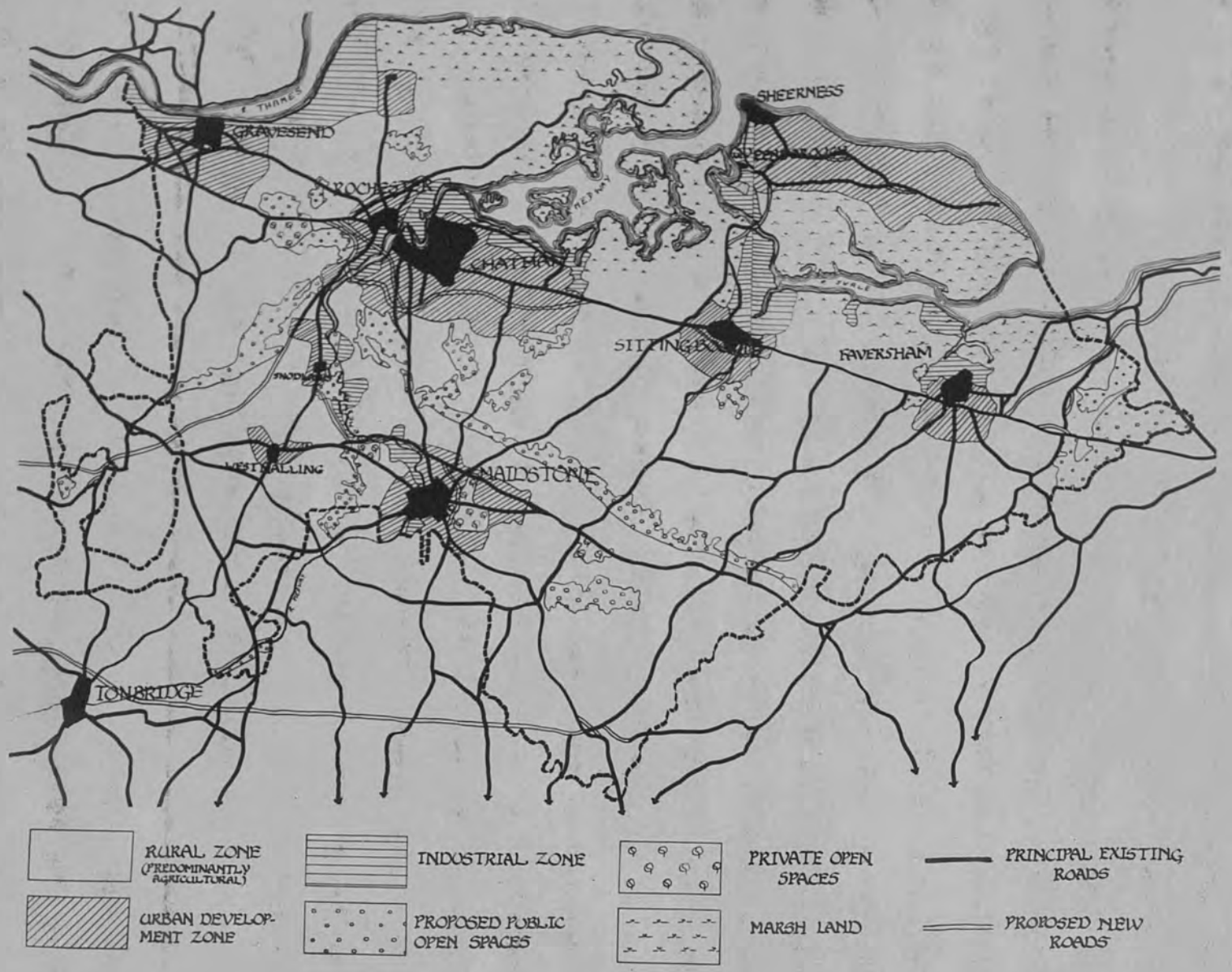

Fig.108. Regional Planning of North East Kent.

rather than the creation of new ones; that there will be a probable extension of existing industrial areas, particularly those devoted to the manufacture of cement; and that most of the area is likely to remain agricultural.

"An external factor which must be taken into account in considering the probable trend of development in the region is the decentralisation and the gradual redistribution of the population of London..... There is little doubt that in the not distant future, a large proportion of the industries of London will be redistributed among a ring of satellite towns.... whose location will be governed very largely by the available transport facilities and the inducement to the necessary migration of labour that can be offered in the shape of agreeable surroundings and accommodation. While N.E. Kent can readily satisfy the latter condition, it is not so well equipped in the matter of transport from the point of view of general distribution. Its useful frontage to the Thames is restricted to the length between Northfleet and Lower Hope Point, E. of which the navigable channel is separated from the land by a wide expanse of mud. The Medway is similarly handicapped below Gillingham and Rochester Bridge is a barrier to all but small craft. Railway communication.... does not afford ready connection with the other parts of England. The region, therefore, is at a disadvantage with the N. and W. of London and it is unlikely

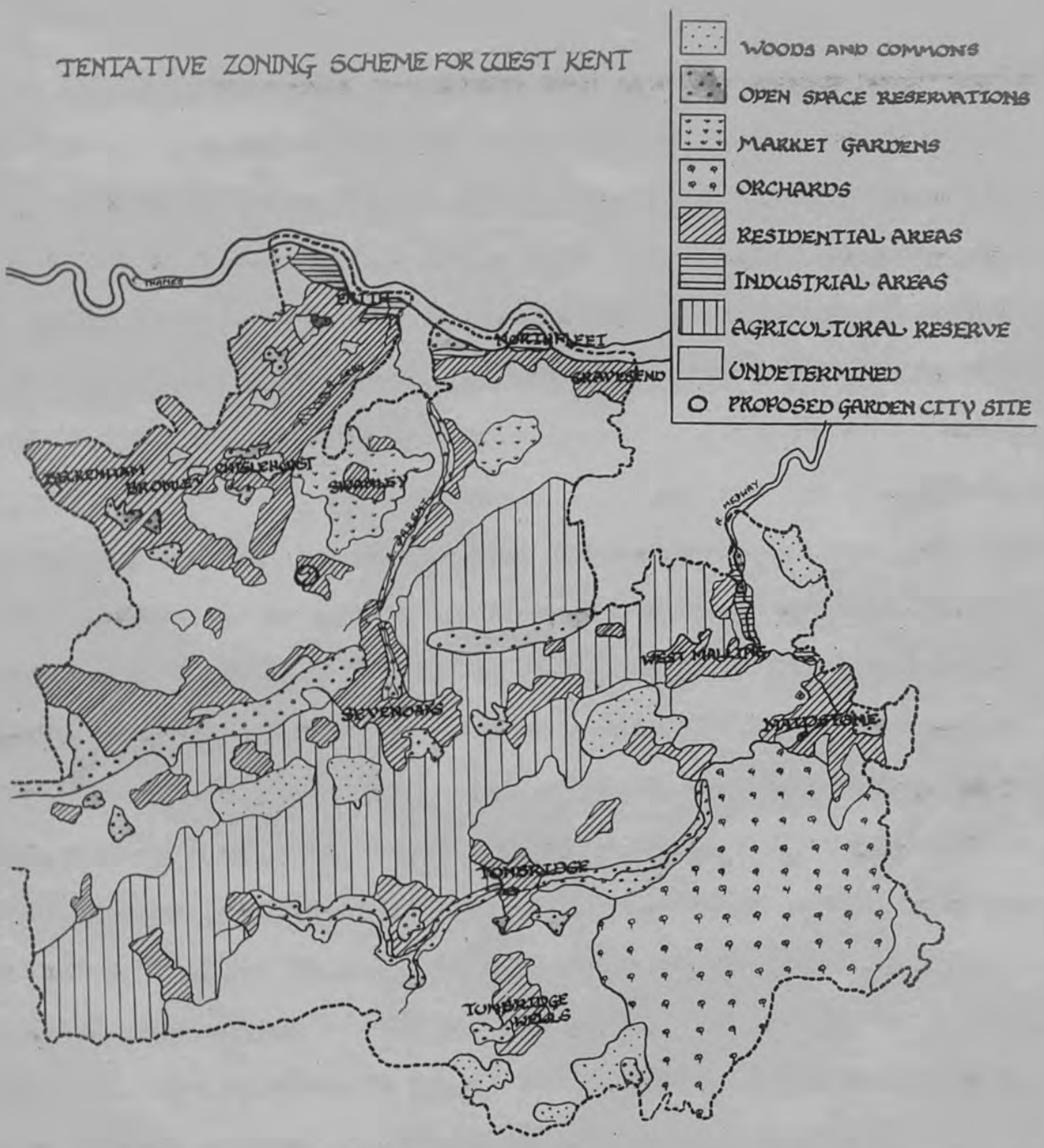

Fig.109.

Prepared from maps in the "West Kent Regional Report" 1927.

to furnish sites for any new satellite towns."[1]

Regions reserved for industrial expansion are therefore extensions of the creek and river valley areas already utilised. The marshlands are in general unfit for either industrial or residential use, and nowhere is expected urban development very extensive except in the N. of Sheppey where a large area is reserved to meet the residential and recreational needs of the industrial hinterland.

The main proposals with regard to open spaces are concerned with the preservation of the crest of the Downs. It is eventually hoped to protect the entire ridge from Dover to Farnham. The main road system of this region where settlement sites and routes are so definitely controlled by the structure of the country, is considered reasonably complete. Exceptions are the coastal road to Thanet already referred to, and links with Sheppey and Sheerness. The chief problem is the improvement of existing routes and the relief of congestion in the gap towns - a problem rendered difficult by topography.

In West Kent the regional plan is concerned mainly with the suitable settlement of London's expanding residential population and the reservation of those areas where agricultural utilisation is likely to be most economic (see Fig.109). Land reser ved for industry is confined to the Thameside and Medway valley. Reserves for residential development spread out round

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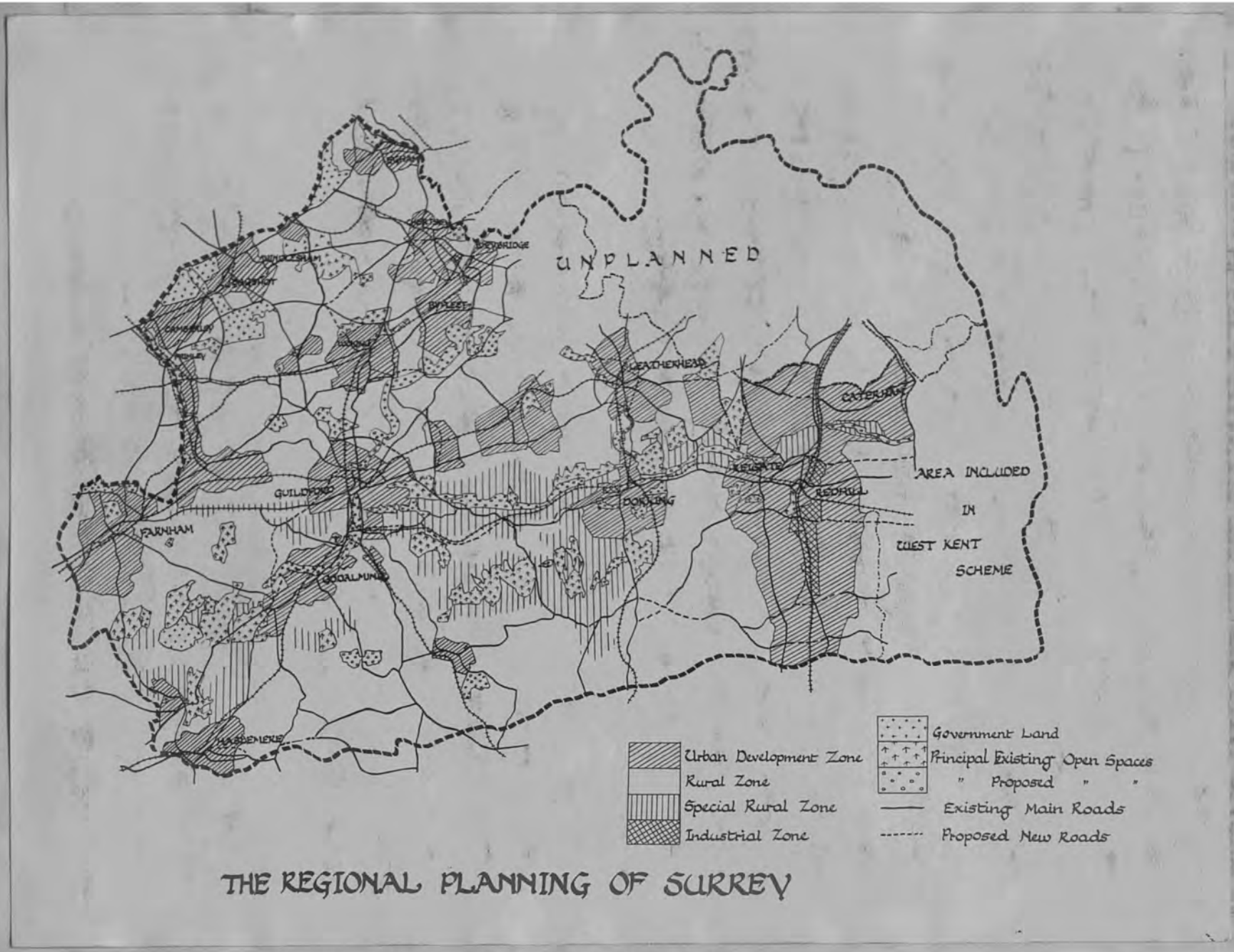
(1) North East Kent Regional Planning Scheme 1930.



THE REGIONAL PLANNING OF SURREY

Fig.110. Prepared from maps published in:-
Mid Surrey Regional Planning Scheme 1928.
N.W. " " " " 1928.
W. " " " " 1931.

present settlement areas and, of course, are largest in the S.E. suburban area, adjoining Bromley, Chislehurst and Bexley. There is in addition, a large area on the dip-slope of the Downs, which represents a S.W. expansion of the Caterham-Croydon region. The two are separated by the thinly settled line of hilly commons and heaths at Hayes and Keston etc.

The agricultural reserve (including orchard land) lies principally on the fertile ragstone soils to the W. of Maidstone; along the Weald Plain and on the E. part of the Chalk dip-slope. Much of the valuable agricultural land of the Medway valley in the neighbourhood of Maidstone, Tonbridge and Tunbridge Wells is not reserved but, under the scheme, may be used for residential development if it appears to be economic.

Route proposals (these are not shown on the map) are concerned mainly with the provision of E-W routes, one along the Vale of Holmesdale and the other along the Weald Plain. The absence of transverse routes and the comparative insignificance of transverse traffic over the whole area has already been remarked (Chap.V.).

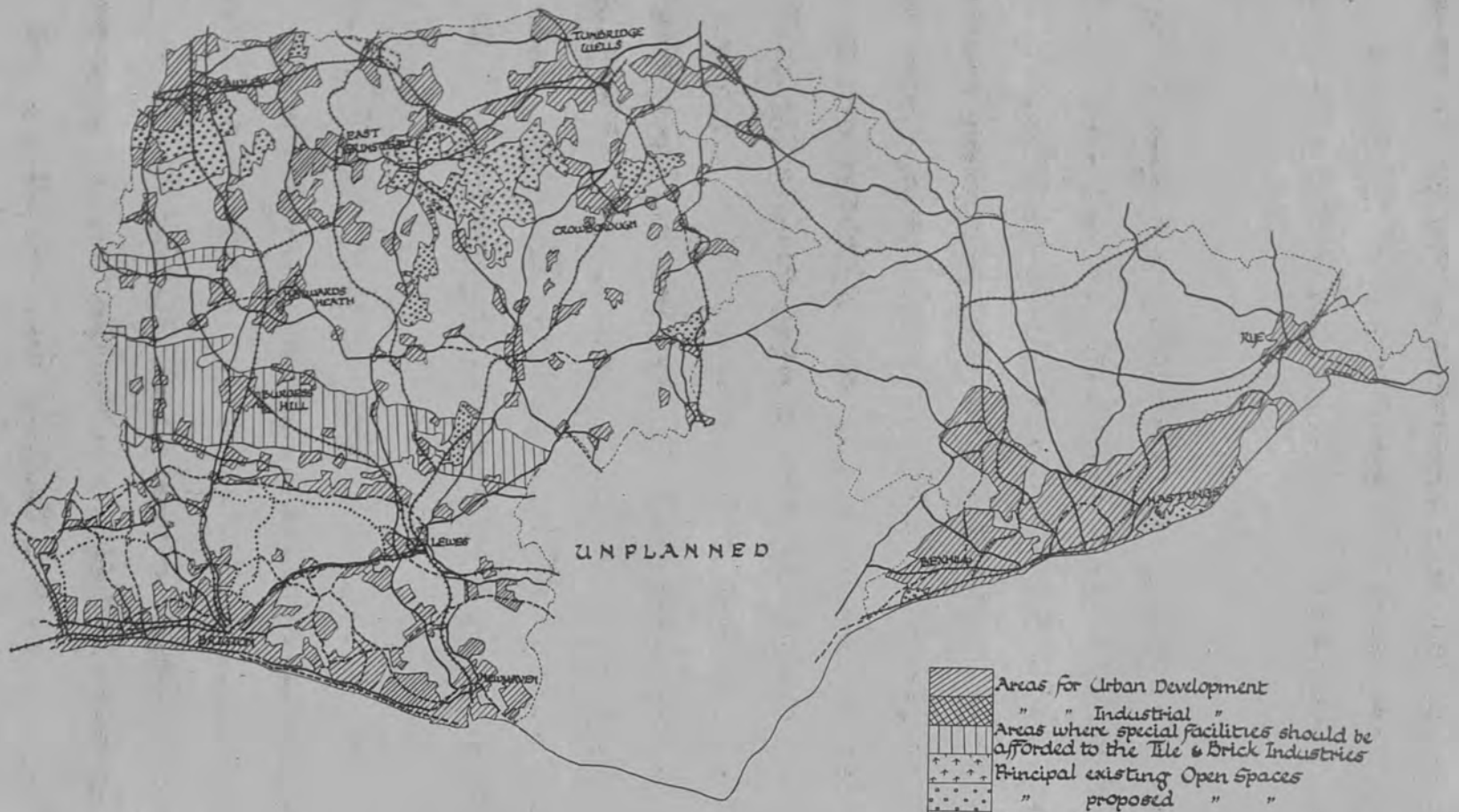
The whole of Surrey has been regionally planned with the exception of the N.E. Sector (see Fig.110). A very limite area is reserved for industrial expansion, which, in this area, would be correlated with the decentralisation of

London industry. The location of sites is entirely controlled by rail-transport, and thus differs entirely from the probable Kentish expansion, resembling rather that of the N. and W. of London. The most conspicuous reserve adjoins the main Brighton line between Redhill and Horley. Other, much smaller, areas adjoin the rail at Leatherhead, Dorking and between Woking and Byfleet.

As a whole, however, the region is planned for residential and recreational uses. The main urban expansion is planned on the Chalk plateau and in areas bordering the main through routes, e.g. following the Portsmouth road through Guildford and Godalming, the Worthing road through Leatherhead and Dorking and the Brighton road through Redhill.

Surrey already possesses wide stretches of reserved parks and commons, but further proposals suggest the reservation of the scarp crest and face of the North Downs, and large areas on the Surrey Hills. It is suggested that these shall be preserved either as open spaces, or as a Special Rural Zone where building shall be strictly controlled. In this zone also are included the water meadows of the Wey and Mole.

Little development is anticipated in the main rural zone lying to the S. of the Greensand scarp, but there is no land which it is felt should be specially reserved for agricultural pursuits as such.



THE REGIONAL PLANNING OF EAST SUSSEX

Fig.111. Prepared from maps published in:-
Regional Planning Scheme of E.Sussex,Northern Area,1931.
Brighton Town Planning Scheme 1928.
South East Sussex Regional Planning Scheme 1931.

Here, as in Kent, the main framework of routes is found to be adequate and proposals are concerned with improving existing roads and providing E-W links between the main longitudinal routes.

In Sussex a similar type of development has been planned as for Surrey. That at present completed for E.Sussex is shown in Fig.111. Small and scattered areas likely to attract industry are reserved adjoining the main rail routes at Crawley, Hayward's Heath, Burgess Hill and Crowborough and a large area has been demarcated on the Weald Clay with Burgess Hill as its centre, where it is considered that special facilities should be afforded to the brick and tile industry. With these exceptions, the plan is concerned with the residential extension of the South Coast towns, and, to a much more restricted extent, to the settlements on the hills of the High Weald and along the foot of the South Down scarp, and with the provision of recreational areas.

Much of the Forest area is already preserved, but provision is made for a more extensive preservation and also for the reservation of open spaces in the main coastal population belt. It is also suggested that Downland above the 300 ft. contour shall be protected from building encroachment (this proposal is not shown on the map). In the Wealden area behind Rye and Hastings, the present rural nature of the country is expected

to persist unchanged. The main route proposals are concerned with the provision of a coastal road from Brighton to Saltdean (now partly built); for better transverse routes along the Downs and for bypass roads to relieve congestion at Lewes and Hastings, etc. In addition, the provision of "Downland Ways" - pleasure routes giving greater accessibility to one of the chief assets of Brighton are proposed.

In W. Sussex regional planning has been restricted to the coast and Downs area. Industrial sites are located at Littlehampton, and at Shoreham adjoining the harbours, and at Worthing in a belt of land bordering the Telville stream, i.e., on land least suited to residential and most suited to industrial use. Careful control of urban development is provided, and it is, of course, primarily connected with the growth of the seaside towns. In this area it is suggested that the Downs over the 150 ft. contour be preserved, and that each urban centre be surrounded by a belt of open land in order that "ribbon" development and the loss of urban individuality may be prevented.

Wherever regional plans have been prepared, regulations as to the type and density of buildings etc. in the different zones, and other aspects of urban and route construction have been outlined with a varying amount of detail.

Plans of this nature are naturally concerned far more with urban and industrial aspects than with rural, (which may be

left more safely to look after itself), and therefore undue emphasis on the relative importance of the areas may result. Nevertheless certain broad considerations emerge which usefully indicate the future character of the region.

These are firstly the expectation of big residential development, marking a growing subordination of the whole to the needs and influences of London. This is most emphasised in Surrey, where the development is of a directly suburban nature, and in Coastal Sussex, where it is both suburban and recreational. Kent, and the Wealden area generally, is less stamped by Metropolitan encroachment, which is controlled more by transport facility than any other factor.

Secondly, any development of industry in Surrey and Sussex is again a reflection of London influences and conditions (with the possible exception of coastal development as at Shoreham etc.) whereas in Kent it is a growth of indigenous industry.

Thirdly, that whereas in Surrey agricultural interest is and will be subordinate to residential, in Sussex and Kent the fundamental importance of agriculture is expected to persist, even in the face of the possible industrialisation of E.Kent.

STATISTICAL APPENDIX.

Table 1 Schedule of Analyses of Coal Seams of 3 ft. and upwards in thickness in order of carbon contents (from Ritchie "The Kent Coalfield") in Kent Borings.

Boring	Thickness of seam ft.	Thickness of seam ins.	Depth ft.	Volatile Matter %	Carbon %	Sulphur %	Ash %	Evaporative Power %	Class of Coal
Ripple	10	0	2761	10.71	84.26	.63	4.40	15.56	Steam
Oxney	9	0	3271	10.02	83.91	.82	5.25	15.21	Smokeless Navigation Steam
"	7	10	3376	10.23	83.50	.77	5.50	15.23	"
"	6	6	2613	13.71	83.20	.99	2.10	15.25	"
Maydensole	5	9	3626	11.25	83.17	.73	4.85	15.32	Steam
Oxney	5	7	2431	13.97	82.32	1.03	2.68	15.06	Navigation Steam
Woodnesborough	4	0	2242	14.01	82.21	.90	2.88	14.92	Steam
Ripple	8	0	2873	10.70	82.03	.64	6.63	15.05	"
Oxney	11	4	3195	10.81	81.50	.93	6.76	14.88	Smokeless Navigation Steam
Ripple	4	8	2698	13.48	81.23	.69	4.60	15.30	Steam
Maydensole	4	9	3569	13.54	81.17	.88	4.41	15.15	"
Ripple	6	10	2177	13.62	81.13	.89	4.36	14.94	"
"	4	0	2405	14.25	80.96	1.34	3.45	15.34	Steam and General Heating
Benfrestone	9	6	3318	15.95	80.63	.50	2.92	15.18	Steam
Goodnestone	4	6	2827	16.30	80.31	.56	2.83	15.34	Navigation Steam
Maydensole	7	6	3721	12.86	79.84	.85	6.45	15.04	Steam
Goodnestone	7	10	2881	15.83	79.33	.79	4.05	14.75	Steam
Maydensole	4	1	3097	14.72	79.33	1.83	4.12	15.02	Navigation Steam
Mattice Hill	3	5	1629	14.96	79,30	.55	5.19	15.11	Steam
Trapham	3	5	2315	18.01	79.16	.71	2.12	15.28	Navigation Steam
Stonehall	9	0	3655	15.64	78.77	.76	4.83	14.89	Steam and House
Maydensole	4	4	2979	17.08	78.66	1.13	3.13	15.23	" "
Benfrestone	8	3	2754	18.28	78.65	1.02	2.05	15.72	Steam and General Heating
Maydensole	4	6	2862	16.30	78.50	.70	4.50	14.93	Steam

Table 1 contd.

Boring	Thickness of seam ft.	Thickness of seam ins.	Depth ft.	Volatile Matter %	Carbon %	Sulphur %	Ash %	Evaporative Power %	Class of Coal
Oxney	4	9	3392	15.51	78.44	.66	5.33	15.34	Smokeless Navigation Steam
Goodnestone	3	6	2642	17.35	78.41	.78	3.46	15.36	"
Benfrestone	4	7	2939	19.02	78.10	.89	1.99	15.41	Steam and House
Goodnestone	6	7	2802	18.38	77.97	.64	3.01	15.78	" "
Ripple	6	2	2062	16.61	77.87	.77	4.75	14.81	Steam and Furnace
Mattice Hill	2	10	1541	16.82	77.87	.92	4.39	15.38	Smokeless Navigation Steam
Woodnesborough	6	7	2294	16.30	77.68	.82	5.20	14.84	Steam
Maydensole	6	8	2235	15.19	77.57	1.25	6.05	14.95	Navigation Steam
Benfrestone	4	0	3260	15.47	77.22	.65	6.66	14.64	Steam "
Stonehall	7	2	2790	19.98	77.22	.80	6.00	15.54	Steam and House
Goodnestone	3	9	2426	20.46	77.21	.78	1.55	16.03	House and Steam
"	4	6	3555	18.48	76.14	2.32	3.06	14.85	Steam, House and General Heating
Trapham	3	5	2541	19.79	75.91	.85	3.45	14.82	Steam and House
Woodnesborough	3	6	1901	21.24	75.78	1.12	1.86	15.24	Navigation Steam, House and General Heating
Trapham	4	1	2635	20.79	75.06	.85	3.30	14.91	Steam and House
Stonehall	8	7	3554	19.39	74.74	1.05	4.82	14.92	Steam, House, General Heating
Woodnesborough	3	2	1606	24.22	72.65	.67	2.46	15.48	"
Benfrestone	2	9	1365	22.70	72.46	1.57	3.33	15.48	Steam and House
Walmestone	6	3	1948	21.04	72.30	.86	5.80	14.47	Steam and House
Benfrestone	4	11	2197	22.81	72.27	1.40	3.52	15.42	Steam and House
Walmestone	7	2	1978	22.81	72.13	.70	4.36	14.78	Steam
Stonehall	6	4	3240	20.60	72.11	1.15	6.14	14.56	Steam and General Heating
"	6	4	3192	19.69	71.92	1.13	7.26	14.65	Steam and House
"	6	3	2419	23.30	71.26	1.49	3.95	14.65	" "

Table 1 contd.

Boring	Thickness of seam ft.	Thickness of seam ins.	Depth ft.	Volatile Matter %	Carbon %	Sulphur %	Ash %	Evaporative Power %	Class of Coal
Walmestone	5	10	2003	20.78	71.08	1.01	7.13	14.27	Steam and House
Stonehall	3	2	2055	25.65	70.64	1.12	2.59	14.83	Steam and House (a)
"	5	2	2109	24.23	70.54	1.67	3.55	14.74	" "
Benfrestone	6	1	1452	25.84	70.07	1.19	2.90	15.50	" "
Trapham	4	9	2479	21.31	74.45	.97	3.27	14.93	" "
Stonehall	6	9	3405	17.83	74.40	.82	6.95	14.52	" "
Woodnesborough	3	0	2127	18.96	74.20	.82	5.92	14.50	" "
"	5	4	2544	12.98	74.12	4.69	8.21	13.91	Steam
Maydensole	3	6	1751	21.65	74.09	.94	3.32	14.80	Steam and House
Stonehall	5	8	3094	19.59	73.40	.95	6.06	14.68	Steam and General Heating
"	4	1	3080	19.95	73.26	1.03	5.76	14.63	House and Steam
Walmestone	3	5	1910	20.12	72.25	.52	6.11	14.53	" "
Woodnesborough	3	9	1755	23.44	73.06	1.14	2.36	15.71	" "
Maydensole	4	4	2158	19.18	72.58	1.51	6.73	14.36	" "
Stonehall	7	2	2985	23.18	70.05	1.44	5.33	14.97	Steam and House
"	6	2	1912	26.02	70.01	1.57	2.46	15.28	Gas and Coking (b)
Walmestone	3	1	1825	21.12	69.93	6.94	8.01	14.76	Steam and House
Trapham	3	10	2075	27.01	69.60	6.91	2.48	15.12	Gas and Coke (c)
Stodmarsh	13	8	1925	24.45	69.14	1.04	5.33	14.48	Steam and House (d)
Stonehall	7	10	3274	22.19	69.11	1.50	7.20	14.51	Steam and House
"	6	6	2284	24.14	69.04	1.77	5.05	14.33	Steam
Fredville	4	4	1560	28.34	68.12	.84	2.70	15.34	Gas, Steam and House (e)
"	4	2	2205	23.90	67.50	1.83	6.77	14.02	Steam, House and Gas
"	4	4	1504	26.88	67.05	2.12	3.95	14.51	Gas and Coke (f)
Walmestone	3	3	1434	27.82	66.63	1.30	4.25	14.53	" " (g)
Trapham	4	2	1900	27.81	65.88	1.23	5.08	14.58	" "

Table 1 contd.

Boring	Thickness of seam ft.	Thickness of seam ins.	Depth ft.	Volatile Matter %	Carbon %	Sulphur %	Ash %	Evaporative Power %	Class of Coal
Waldershare	5	2	2372	40.23	52.66	-	1.90	14.73	Gas (h)

(a)	Gas	per	ton:	11,000	cubic	feet:	Candle	power	16.5
(b)	"	"	"	11,500	"	"	"	"	17.0
(c)	"	"	"	12,250	"	"	"	"	16.5
(d)	"	"	"	11,000	"	"	"	"	16.0
(e)	"	"	"	11,450	"	"	"	"	15.4
(f)	"	"	"	11,800	"	"	"	"	17.0
(g)	"	"	"	12,000	"	"	"	"	17.5
(h)	"	"	"	13,000	"	"	"	"	23.5

Table 2.

Total Quality of Saleable Coal
Raised in England and Wales 1931.

District.	Amount in tons.
South Wales and Monmouth	37,044,852
Durham	30,248,866
South Yorkshire	28,979,364
Nottinghamshire	14,483,415
Lancashire & Cheshire	14,114,961
North Derbyshire	12,645,665
Northumberland	12,495,865
West Yorkshire	11,610,280
North Staffordshire	5,361,216
Warwickshire	4,774,570
Cannock Chase	4,724,832
North Wales	3,116,782
Leicestershire	2,612,903
Kent	1,585,750
Cumberland & Westmoreland	1,513,418
South Staffordshire and Worcestershire	1,477,620
Forest of Dean	1,135,490
South Derbyshire	816,007
Somerset	802,751
Shropshire	642,332
Bristol	159,651

Table 3.

Output of Saleable Coal in Kent 1911,1931.

Year	Amount in tons
1911	150
1912	1,099
1913	59,203
1914	130,440
1915	158,389
1916	208,623
1917	255,583
1918	235,819
1919	277,829
1920	378,000
1921	259,613
1922	403,911
1923	488,195
1924	330,197
1925	367,589
1926	213,969
1927	636,911
1928	929,803
1929	1,148,968
1930	1,291,680
1931	1,585,750

Table 4 — Output of coal per annum at each Colliery in Kent, in tons.

Year	Tilmanstone	Chislet	Snowdown	Betteshanger
1913	40,054		45,000	
1914	82,310			
1915	41,546			
1916	103,040			
1917	135,550			
1918	129,605			
1919	149,019			
1920	166,177			
1921	92,632			
1922	170,603	260,000		
1923	220,102	275,000		
1924	203,190	275,000	closed down	
1925	252,584	170,000		
1926	105,424		reopened	opened
1927	221,343			
1928	312,603	223,000	333,647	
1929	319,871	264,000	459,352	67,668
1930	324,770		481,958	196,979
1931		360,000	501,903	376,652

Table 5 Number of Persons employed in Mines in Kent.

Year	Below Ground	Above Ground			Total Employed
	Males	Males & Females		Total	
1909	170	150	-	150	320
1910	310	351	-	351	661
1911	282	425	-	425	707
1912	337	443	-	443	780
1913	620	514	-	514	1,134
1914	609	496	-	496	1,105
1915					965
1916					1,128
1917					1,098
1918					1,299
1919					1,954
1920					2,402
1921	1,556	519	1	520	2,076
1922	1,370	430	5	435	1,805
1923	1,499	616	1	617	2,116
1924	1,201	541	1	542	1,743
1925	1,453	419	1	420	1873
1926	1,647	695	1	696	2,373
1927	2,087	707	1	708	2,795
1928	2,764	788	1	789	3,553
1929	3,412	943	2	945	4,357
1930	4,076	985	3	988	5,064
1931	4,666	1,009	3	1,012	5,678

Table 6 . Number of Men employed at each Colliery in Kent.

Year	Tilmanstone		Chislet		Snowdown		Betteshanger	
	Below Ground	Above Ground	Below Ground	Above Ground	Below Ground	Above Ground	Below Ground	Above Ground
1913								
1919								
1920								
1921					367	193		
1922	526	146	750	165				
1923			800	170				
1924	650	160	800	170				
1925	650	160	500	150				
1926	650	160	500	150				
1927	650	200	500	150				
1928	650	200	500	150	354	187		
1929	730	270	900	150	1502	265	484	198
1930	780	270	1079	149				
1931	730	270	1200	150	1860		1730	

Table 7. List of Paper Mills in Kent 1932.

Numbers refer to those on Map showing location of Mills (Fig. 40).

A. Producing Hand Made Paper.

1. Ford Mill
2. Hayle
3. Springfield and Medway
4 & 5. Eynsford

B. Producing Machine Made Paper.

6. Chartham
7. Lower Tovil
8. Turkey
9. East Malling
10. Basted
11. Cray Valley
12. St Mary Cray
13. Iping
14. Buckland, Dover
15. Roughway
16. Horton Kirby
17. Hawley
18. Riverside, Dartford
19. Snodland
20. Tovil
21. Aylesford
22. Dartford
23. Empire, Greenhithe
24. New Northfleet
25. British Vegetable Parchment, Northfleet
26. Kent Kraft, Northfleet
27. Kent Paper Sack, Northfleet
28. Bowaters, Northfleet
29. Imperial, Gravesend
30. Sittingbourne
31. Kemsley
32. Conqueror, Dover
33. Bridge, Tovil.

Table 8. The Number of Days during the months April, May, September, October, on which frost occurred in S.E. England 1911-1930.

Station	1911	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
April																				
Margate	4	0	2	2	2	0	13	2	4	0	1	2	0	1	0	0	0	0	5	0
Dover	6	8	5	0	8	2	18	1	7	0	-	3	1	2	1	0	0	0	0	0
St Leonards	6	3	4	0	11	-	14	4	9	0	5	8	2	9	4	2	1	4	7	0
Brighton	7	4	3	2	7	4	14	6	15	0	3	2	1	13	0	0	2	6	10	1
Worthing	9	4	4	1	6	8	16	5	12	1	4	9	2	12	3	0	3	-	-	-
Bognor	11	7	-	5	8	9	13	1	8	1	4	4	0	-	8	0	6	-	-	-
Selsey Bill		9	2	0	7	6	13	6	5	0	4	5	1	9	2	1	1	3	12	1
Wisley	11	22	11	20	14	12	24	15	13	8	21	20	13	15	18	14	10	15	21	9
Sevenoaks	9	6	7	8	14	11	18	13	12	4	13	17	7	15	4	2	-	-	-	-
Tunbridge Wells	12	12	-	-	11	14	19	12	19	11	14	18	18	15	13	12	13	11	20	9
Canterbury	-	-	-	-	-	4	13	7	8	4	5	7	1	2	3	7	12	9	15	12
Ardingly	-	-	-	-	-	16	22	14	17	7	8	15	4	13	7	3	6	9	17	7
May																				
Margate	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Dover	1	3	0	1	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	1
St Leonards	0	0	0	0	-	-	0	0	0	0	0	0	0	1	0	1	1	0	1	0
Brighton	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Worthing	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	-	-	-
Bognor	-	1	-	2	1	1	0	0	0	1	1	-	-	-	0	0	1	-	-	-
Selsey Bill	-	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	2	1	0
Wisley	3	4	7	10	5	8	8	5	5	8	13	8	4	5	4	10	9	10	11	4
Sevenoaks	0	2	0	0	1	0	1	0	0	1	2	5	2	2	0	2	-	-	-	-
Tunbridge Wells	4	3	-	-	4	7	3	2	4	7	3	10	10	4	2	8	8	8	9	3
Canterbury						0	2	0	0	1	1	0	0	-	0	3	8	2	7	2
Ardingly						4	2	1	0	2	1	5	4	2	1	1	2	2	3	0
September																				
Margate	0	-	0	0	0	0	0	0	1	0	0	-	0	0	0	0	0	0	0	0
Dover	0	0	0	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	0	0
St Leonards	0	0	0	0	-	-	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Brighton	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Worthing	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	-	-	-
Bognor	1	-	-	0	0	0	0	0	1	0	0	0	0	0	0	0	0	-	-	-
Selsey Bill	-	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Wisley	4	5	1	7	5	4	1	2	6	3	5	3	10	0	9	7	3	7	2	0
Sevenoaks	0	0	0	1	2	0	0	0	3	0	0	0	0	0	0	0	-	-	-	-
Tunbridge Wells	0	2	-	3	4	3	0	1	4	0	-	4	5	0	9	7	5	6	0	0
Canterbury						0	0	0	2	0	0	0	1	0	2	3	1	4	2	0
Ardingly						1	0	1	2	0	0	0	0	0	0	0	0	0	0	0
October																				
Margate	0	-	0	0	0	0	2	0	2	2	0	-	0	0	0	1	0	0	0	0
Dover	3	1	0	0	0	2	20	2	3	-	0	0	0	0	0	1	0	0	1	0
St Leonards	2	1	0	0	-	-	4	0	2	0	0	3	0	0	2	3	0	0	4	1
Brighton	1	3	0	0	0	1	3	1	3	0	0	2	2	1	1	1	0	2	3	1
Worthing	3	4	0	1	1	1	7	0	11	0	1	3	0	0	1	2	0	-	-	-
Bognor	7	-	-	0	3	0	2	0	7	0	0	1	-	0	2	5	0	-	-	-
Selsey Bill	-	1	0	0	2	0	2	1	6	0	1	3	1	-	1	4	0	5	7	1
Wisley	11	17	5	10	11	8	18	11	24	10	11	18	10	4	9	13	11	7	14	7
Sevenoaks	2	16	0	3	4	4	11	4	11	2	3	8	2	1	1	8	-	-	-	-
Tunbridge Wells	6	11	-	6	7	8	14	9	19	7	10	11	5	5	8	11	12	6	12	6
Canterbury	-	-	-	-	-	4	4	3	8	12	0	4	0	1	3	9	4	6	15	6
Ardingly	-	-	-	-	-	5	16	8	10	9	0	5	4	3	1	7	2	2	11	2

Table 9

The Variation in the Number of Farmers in Each Rural District of Kent, Surrey and Sussex 1921 - 1931.

Kent Rural District	Inc. or Dec.	% Inc. or Dec.	Surrey Rural District	Inc. or Dec.	% Inc. or Dec.	Sussex Rural District	Inc. or Dec.	% Inc. or Dec.
Blean	-4	-3%	Chertsey	-14	-11	Battle	+16	+7
Bridge	+5	+2	Dorking	-8	-5	Chailey	-13	-4
Bromley	-17	-9	Epsom	+16	16	Cuckfield	-18	-7
Cranbrook	+28	+11	x Farnham	-27	-20	Eastbourne	+10	+12
Dartford	-2	-1	x Godstone	-29	-13	E. Grinstead	-22	-10
Dover	-3	-2	Guildford	-15	-13	Hailsham	-83	-13
East Ashford	+30	+8	Hambledon	-29	-7	x Newhaven	-53	-50
Eastney	-43	-15	Reigate	+17	+7	Rye	-31	-16
Elham	+14	+4				Ticehurst	+19	+8
Faversham	+36	+16				Uckfield	-88	-14
Hollingbourne	+9	+2						
Hoo	-5	-8				East Preston	-33	-36
Isle of Thanet	0	0				Horsham	-55	-12
Maidstone	0	0				Midhurst	-9	-4
Malling	-34	-14				Petworth	-10	-5
x Milton	-38	-20				Steyning West	-1	-1
Romney Marsh	+8	+8				Thakeham	-38	-17
Sevenoaks	-8	-2				Westbourne	-20	-10
Sheppey	-9	-2				Westhampnett	-22	-8
Strood	-1	0						
Tenterden	+9	+3						
Tonbridge	+8	+3						
W. Ashford	+8	2						

x The figures for these areas are not reliable owing to intercensal boundary changes within them.

Table 10 — Acreage under Crops & Grass & Number of Livestock in S. E. England: June 1930.

	Wheat	Barley	Oats	Rye	Total Cereals	Turnips & Swedes	Mangolds	Total Roots	Cabbage Kohl-Rabi & Rape	Vetches & Tares	Lucerne
Kent	29463	20576	34415	402	84856	8909	8174	17083	7256	3366	6506
Surrey	8225	1911	12303	499	22938	2716	2946	5662	1964	952	259
East Sussex	10941	1264	16830	235	29270	2186	3672	5858	3263	1335	264
West Sussex	17411	4494	20753	233	42891	7096	5475	12571	2581	1794	321
Total S.E. England	66040	28245	84301	1369	179955	20907	20267	41174	15064	7447	7350

	Clover, Sainfoin & Rotation Grasses		Total Fodder Crops other than Roots	Beans	Peas	Potatoes	Sugar Beet	Hops	Small fruit	Orchard fruit	Total fruit
	For Hay	Not for Hay									
(contd)											
Kent	20517	4534	42179	3955	7007	14252	604	11820	16572	60687	77259
Surrey	8415	2595	14185	581	680	3026	55	140	617	1870	2487
East Sussex	10058	2985	17905	1297	1152	1737	105	1614	771	3221	3992
West Sussex	15800	3645	24141	761	1113	1597	1732	66	753	2069	2822
Total S.E. England	54790	13759	98410	6594 See Note I	9952	20612	2496	13640	18713 See Note II	67847	86560

	Permanent Grass		Rough Grazing	Total Grassland	Total Arable Land	Total land utilised for agriculture	Dairy Cattle	Other Cattle	Total Cattle	Sheep	Pigs
	For Hay	Not for Hay									
(contd)											
Kent	127699	269124	35506	432329	271679	704008	46049	47796	93845	740883	62196
Surrey	63326	72365	24636	160327	58533	218860	23949	15578	39527	35031	21715
East Sussex	101617	145863	51680	299160	68762	367922	42820	34252	77072	155342	19480
West Sussex	61822	88552	37030	187404	95038	282442	29009	22383	51392	100162	14903
Total S.E. England	354464	575904	148852	1079220	494012	1573232	141827	120009	261836	1031418	118294

Compiled from returns made to the Ministry of Agriculture.

N.B. 1. Beans and Peas are not included in Total Fodder Crops, since the acreage does not represent Beans and Peas grown solely for fodder.

2. Orchard Fruit acreage includes acreage of small fruit grown in orchards.

Table 11

Variation in Acreage Under Crops and Grass and in Number of Livestock during period 1913 - 1930, together with Percentage of Variation on 1913 amounts in Kent, Surrey and Sussex.

	Wheat	% Var.	Barley	% Var.	Oats	% Var.	Rye	% Var.	Total Cereals	% Var.	Turnips & Swedes	% Var.	Mangolds	% Var.	Total Roots	% Var.	Cabbage Kohl-Rabi & Rape	% Var.	Vetches & Tares	% Var.	Lucerne	% Var.
Kent	17858	37.7	9843	32.4	9118	20.9	425	51.4	37244	30.4	5486	38.1	3707	31.2	9193	35.0	164	2.3	1755	34.3	3096	32.2
Surrey	7719	48.4	2724	58.8	7377	37.5	595	54.4	18415	44.5	3744	58.0	4497	60.4	8241	59.3	56	2.9	879	48.1	349	57.4
East Sussex	8700	44.3	746	37.2	7898	31.9	271	53.6	17615	37.6	1578	41.9	2265	38.2	3843	39.6	1725	34.6	1504	53.0	355	57.4
West Sussex	9937	36.3	1053	19.0	9613	31.7	298	56.1	20901	32.8	5924	45.5	3773	40.8	9697	43.5	467	15.3	524	22.6	11	3.3
Total S.E. England	44214	40.1	14366	34.4	34006	28.1	1589		94175	34.3	16732	44.4	14242	41.3	30974	42.9	1972	14.6	4662	38.5	3811	34.2

	Clover, Sainfoin & Rotation Grasses: For Hay		Clover, Sainfoin & Rotation Grasses: Not for Hay		Total Fodder Crops other than Roots		Beans		Peas		Potatoes		Sugar Beet		Hops		Small fruit		Orchard fruit		Total fruit	
(contd)																						
Kent	4559	18.2	922	16.9	9168	17.5	3459	46.7	3874	35.6	1767	11.03		-	10124	46.1	7727	31.8	22905	60.6	15178	24.4
Surrey	5634	40.1	412	13.7	7218	33.7	465	44.5	848	55.5	2321	43.4	48	685.7	417	74.9	367	37.3	687	26.9	1054	29.8
East Sussex	4464	30.7	1098	26.9	9146	35.1	1715	56.9	1562	57.6	432	19.9		-	1174	42.1	217	39.2	1311	68.6	1528	62.0
West Sussex	4853	23.5	755	17.2	6510	21.2	61	7.4	735	39.8	133	9.1		-	35	34.6	94	14.3	636	44.4	730	34.9
Total S.E. England	19510	26.2	3187	18.8	32042	24.3	5700 (See Note XI)	46.3	7019	41.4	4377	17.5	48	685.7	11750	46.3	7783	29.4	24165 See Note III	56.6	16382	23.3

	Permanent Grass: For Hay		Permanent Grass: Not for Hay		Rough Grazing		Total Grassland		Total Arable Land		Total land utilised for agriculture		Dairy Cattle		Other Cattle		Total Cattle		Sheep		Pigs	
(contd)																						
Kent	11546	8.3	28232	9.5	24348	218.2	15430	3.4	24557	8.3	39987	5	8382	22.3	1903	3.8	6479	7.4	123378	14.3	6387	11.4
Surrey	18124	22.3	6948	8.8	17111	227.4	7961	4.7	39051	40.0	47012	17.7	1520	6.8	4509	22.4	2989	7.0	12464	26.2	597	2.7
East Sussex	1119	1.1	19711	11.9	41171	391.8	20341	7.3	32802	32.3	12461	3	7468	21.1	8689	20.2	1221	1.6	77417	33.3	350	1.8
West Sussex	1228	1.9	400	0.4	23614	176.0	21986	13.3	33269	25.9	11283	4	6780	30.5	2283	9.3	4497	9.6	46260	31.6	3135	17.4
Total S.E. England	32017	23.3	55291	8.7	106244 See Note IV	249.2	18936	1.8	29679	20.8	110743		24150	20.5	17384		6766		259519		2305	

compiled from returns made to the Ministry of Agriculture.

See next page for notes.

N.B. 1. Red figures denote increases, black figures decreases.

2. Beans and Peas are not included in Total Fodder Crops, since the acreage does not represent Beans and Peas grown solely for fodder.

3. Orchard Fruit acreage includes the figure for small fruit grown in orchards.

4. Although there has been a steady increase in the total area of land returned as Rough Grazings, the figures of 1913 and 1930 are not strictly comparable owing to (1) some difference in the method of collecting data and (2) the fresh estimate of the area of common rough grazings made in 1921. As a result the increase in rough grazings appears more marked than is the actual fact and in order to make the figure for variation in Grassland as accurate as possible, the acreages of both Rough Grazings and Permanent Grassland have been taken into consideration.

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